OCS EIS/EA
MMS 2001-079

Outer Continental Shelf Oil & Gas Leasing Program: 2002-2007

Draft Environmental Impact Statement
October 2001

Volume II

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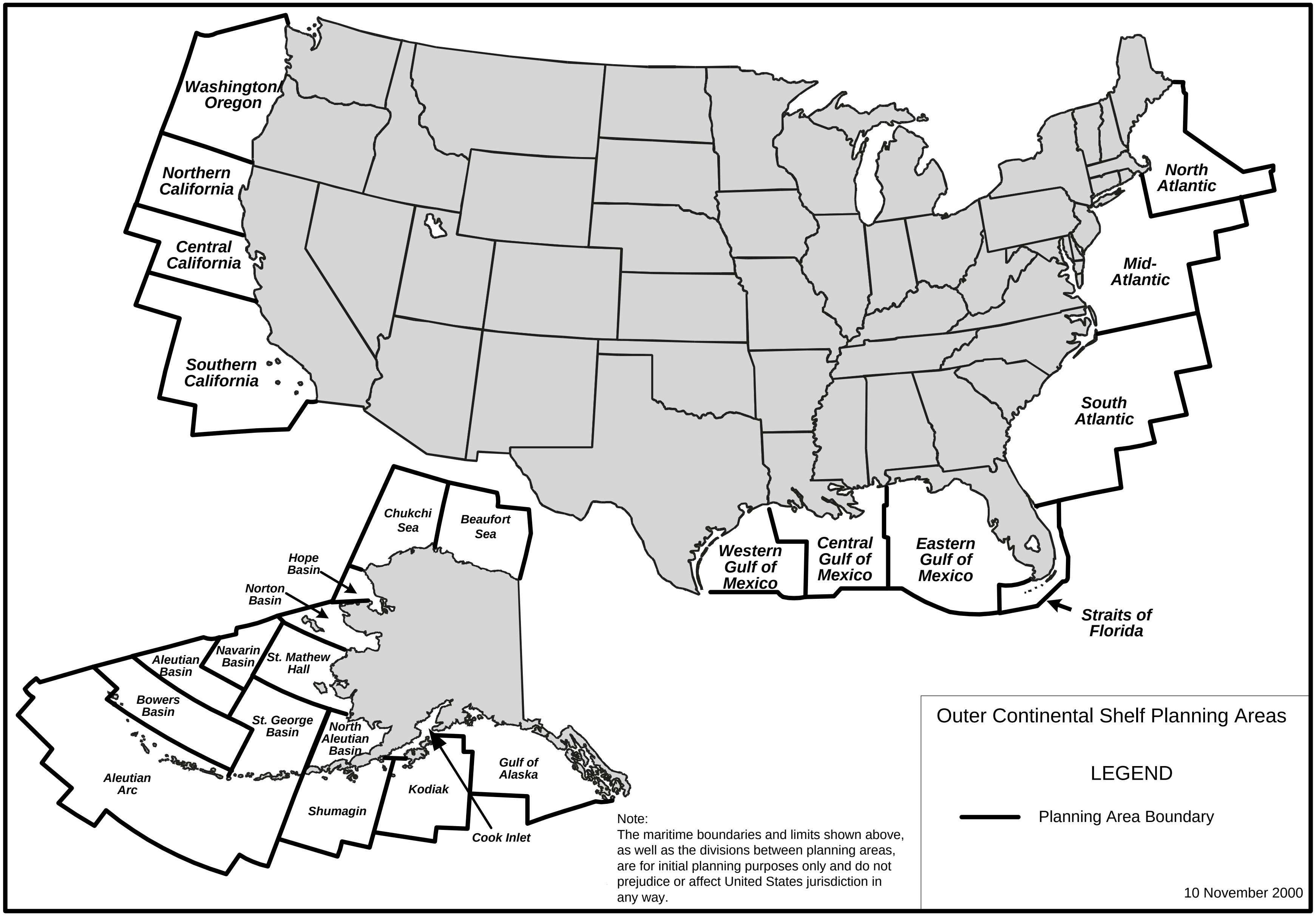

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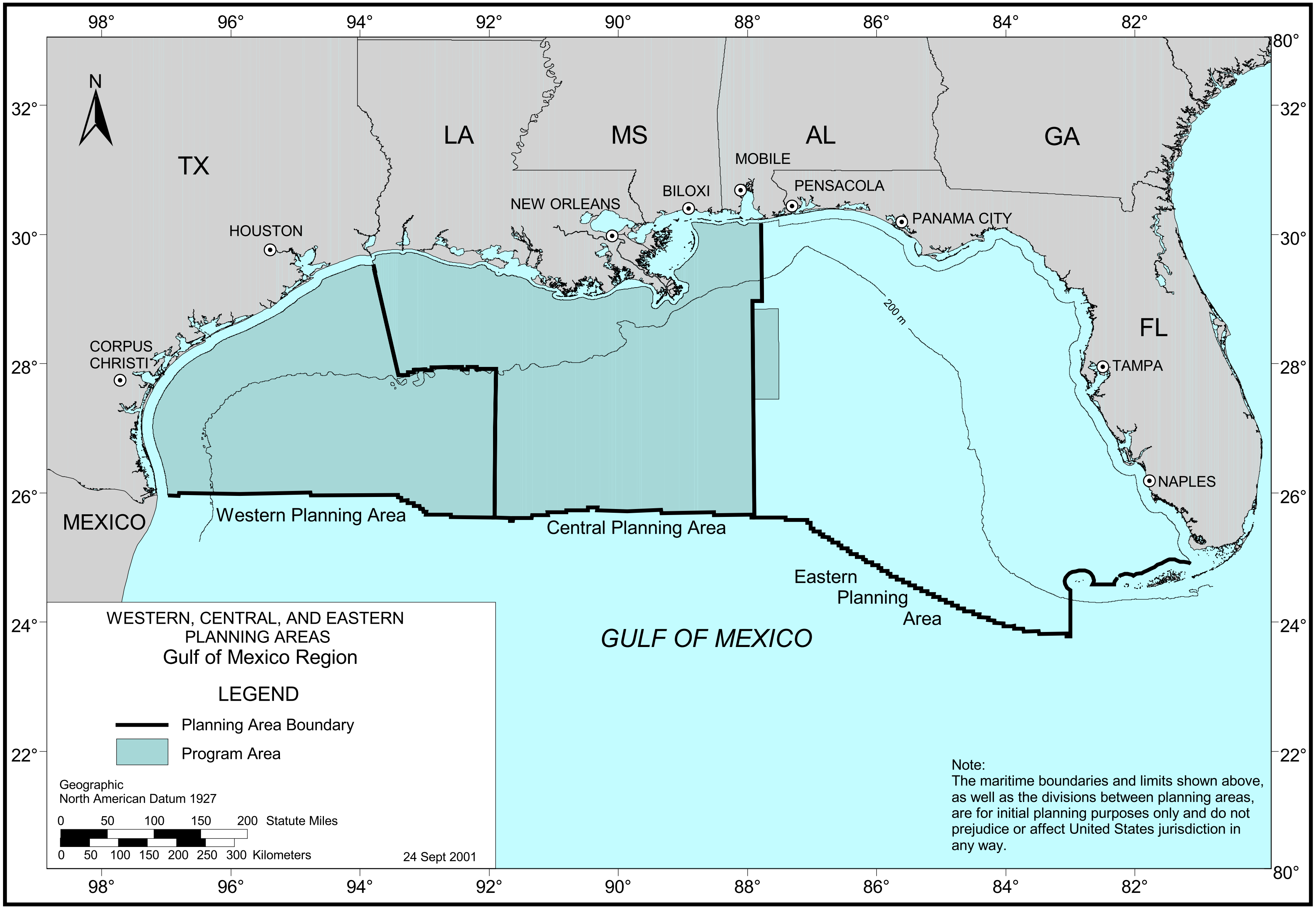

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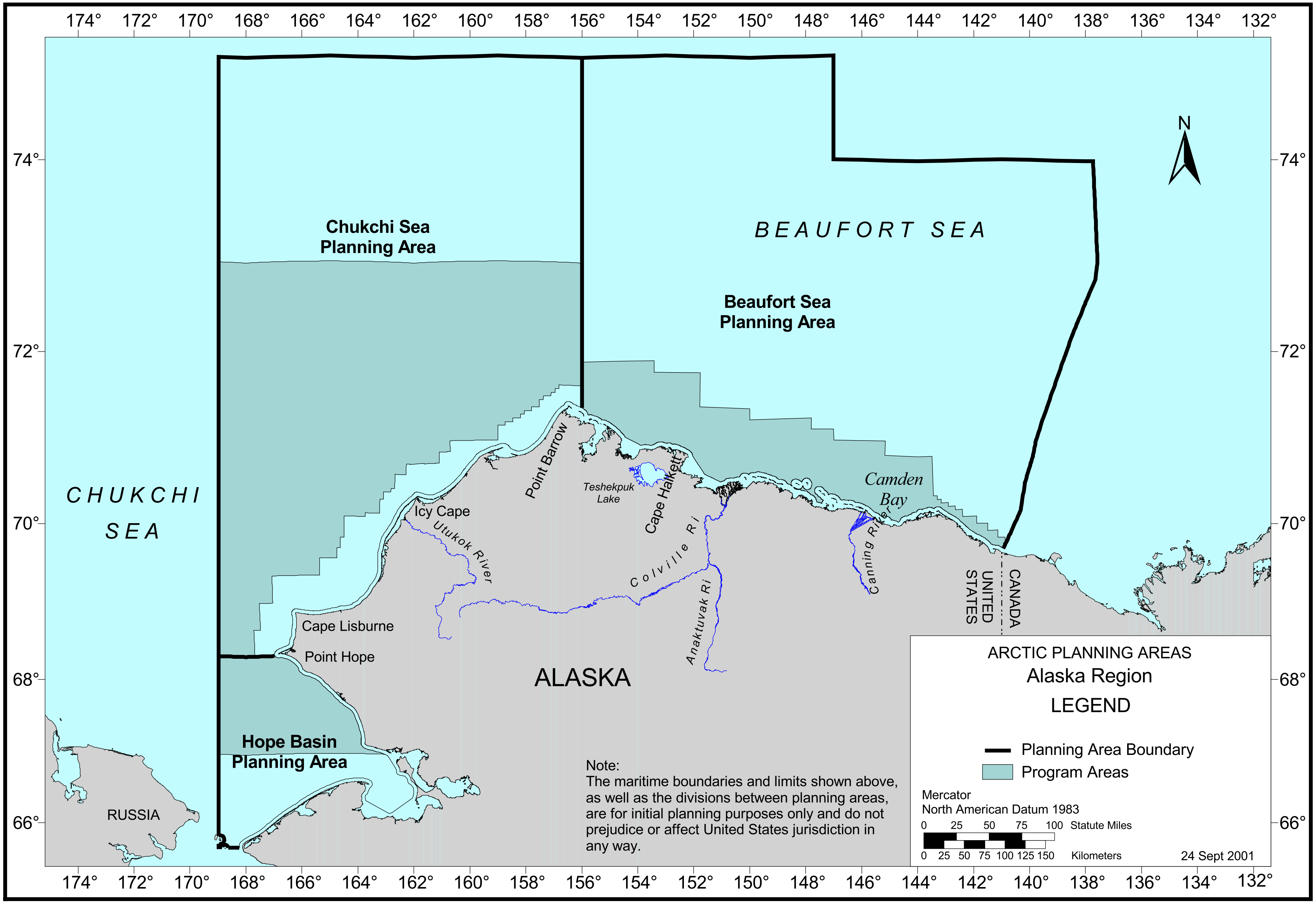

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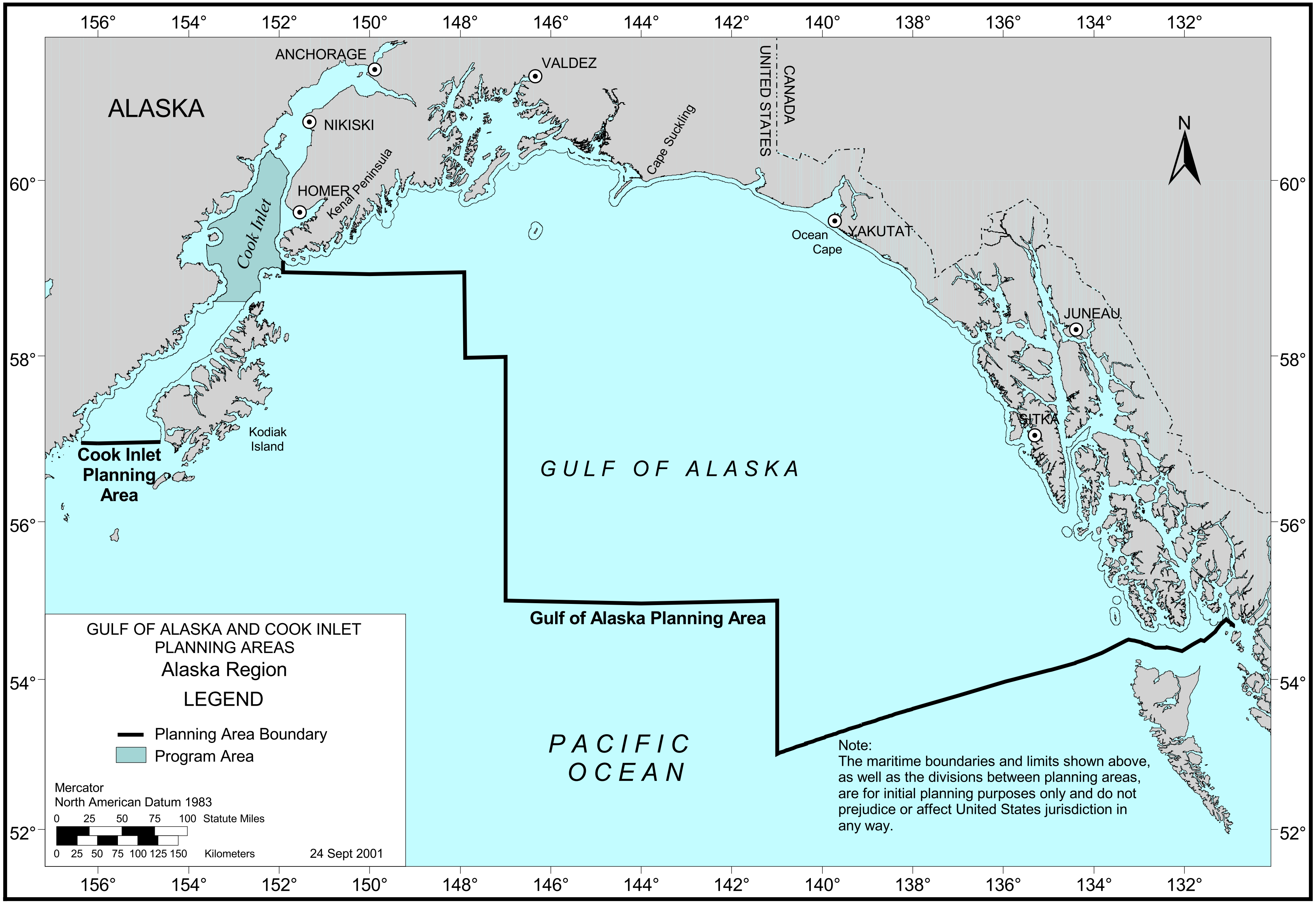

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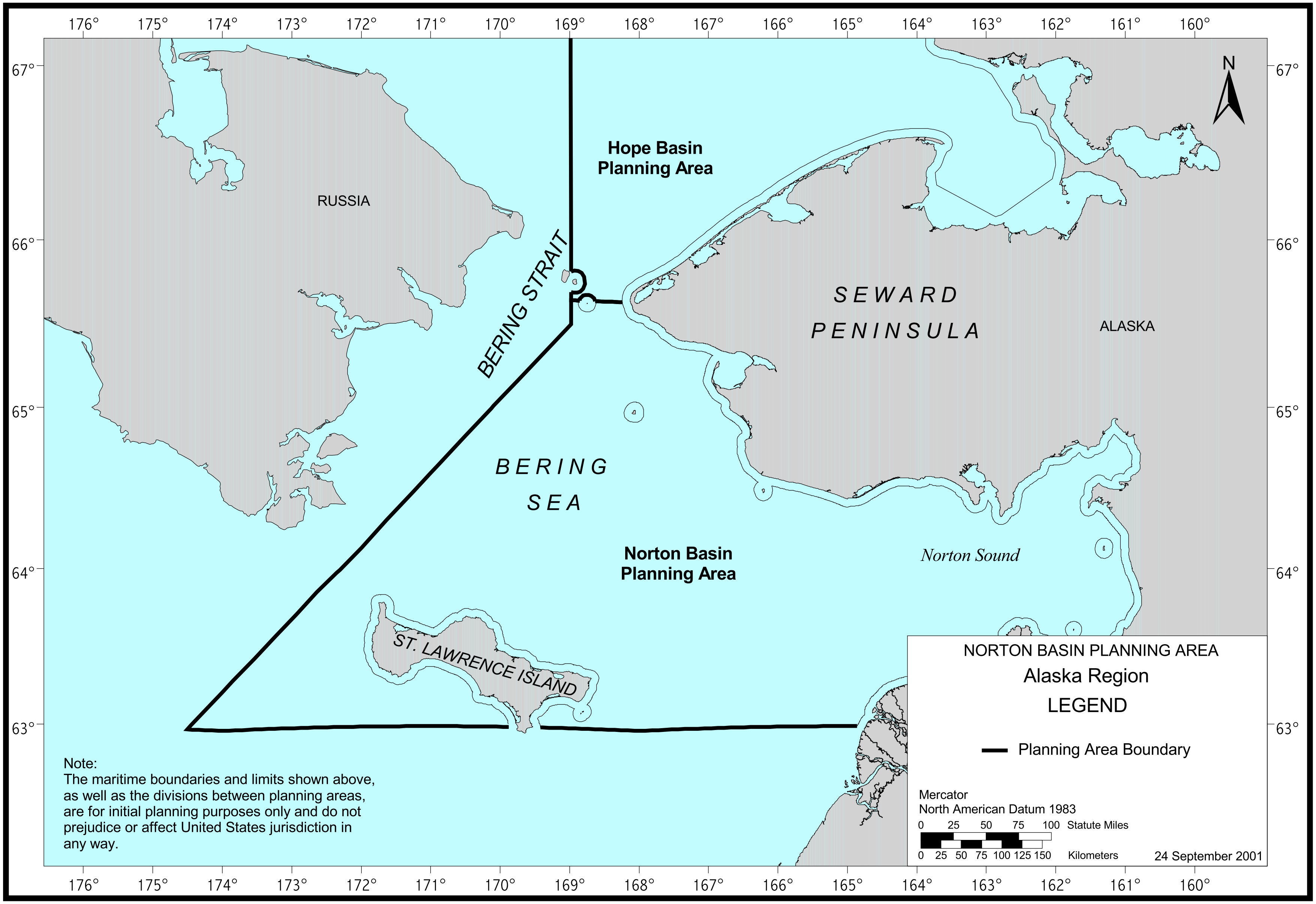

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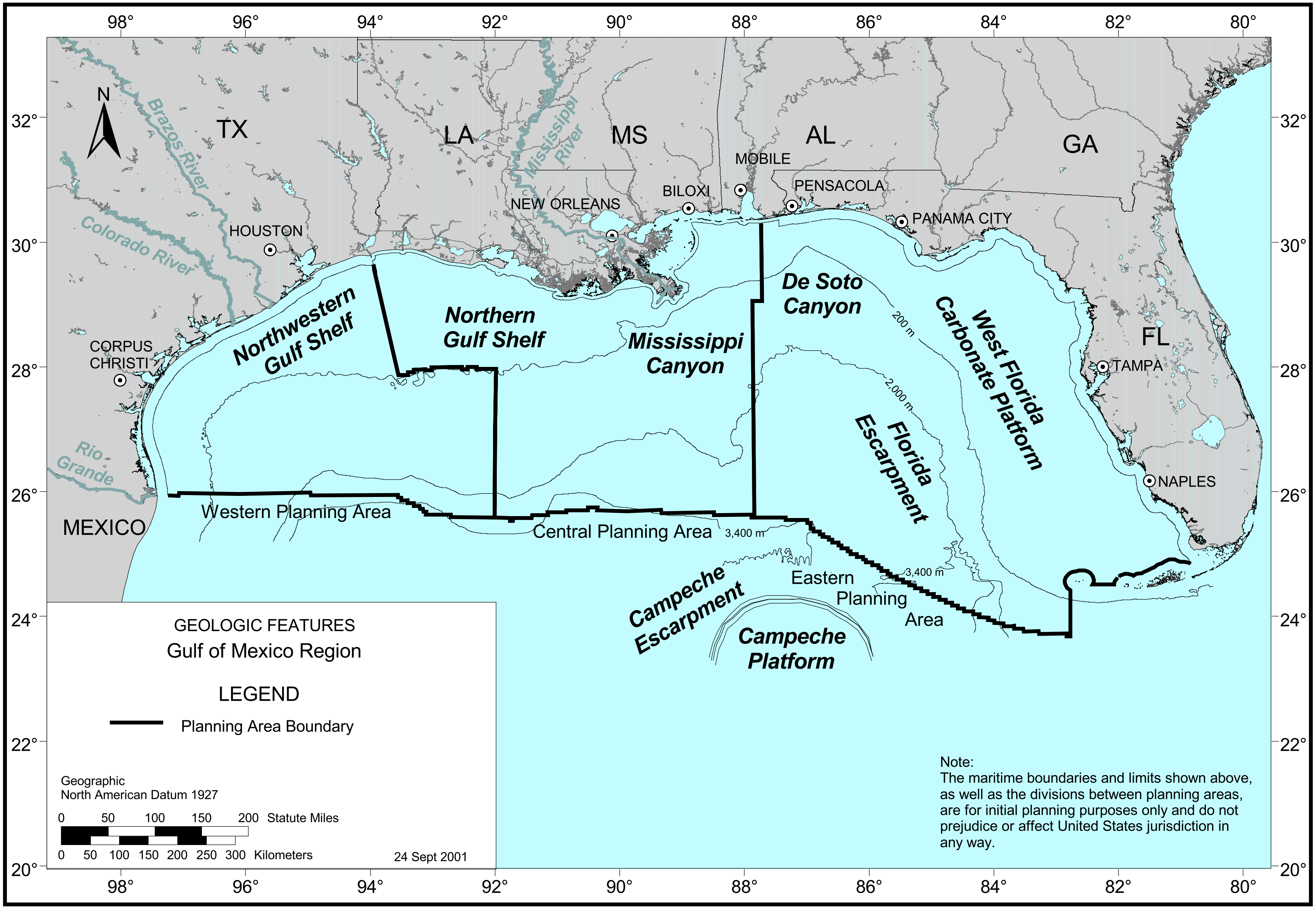

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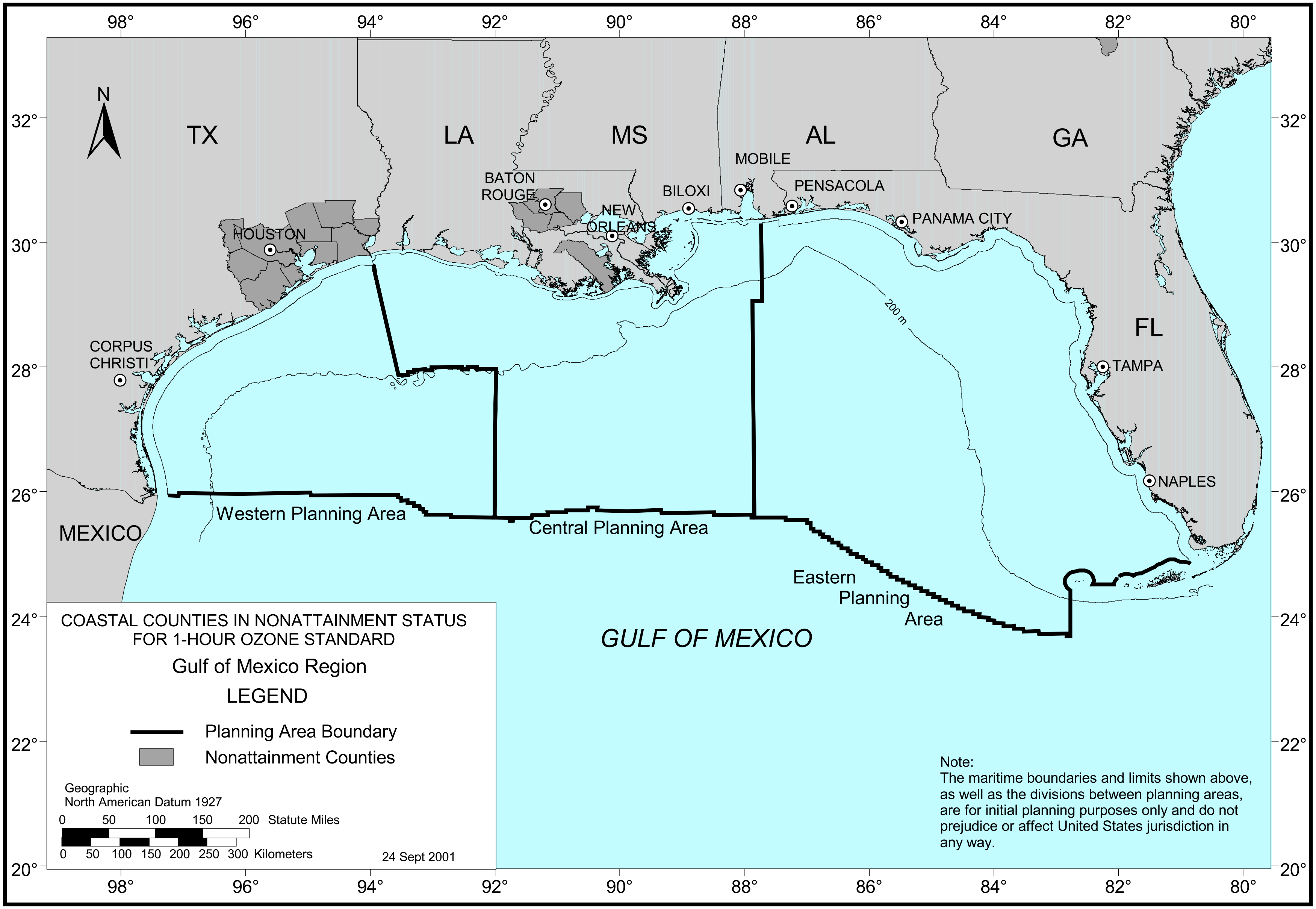

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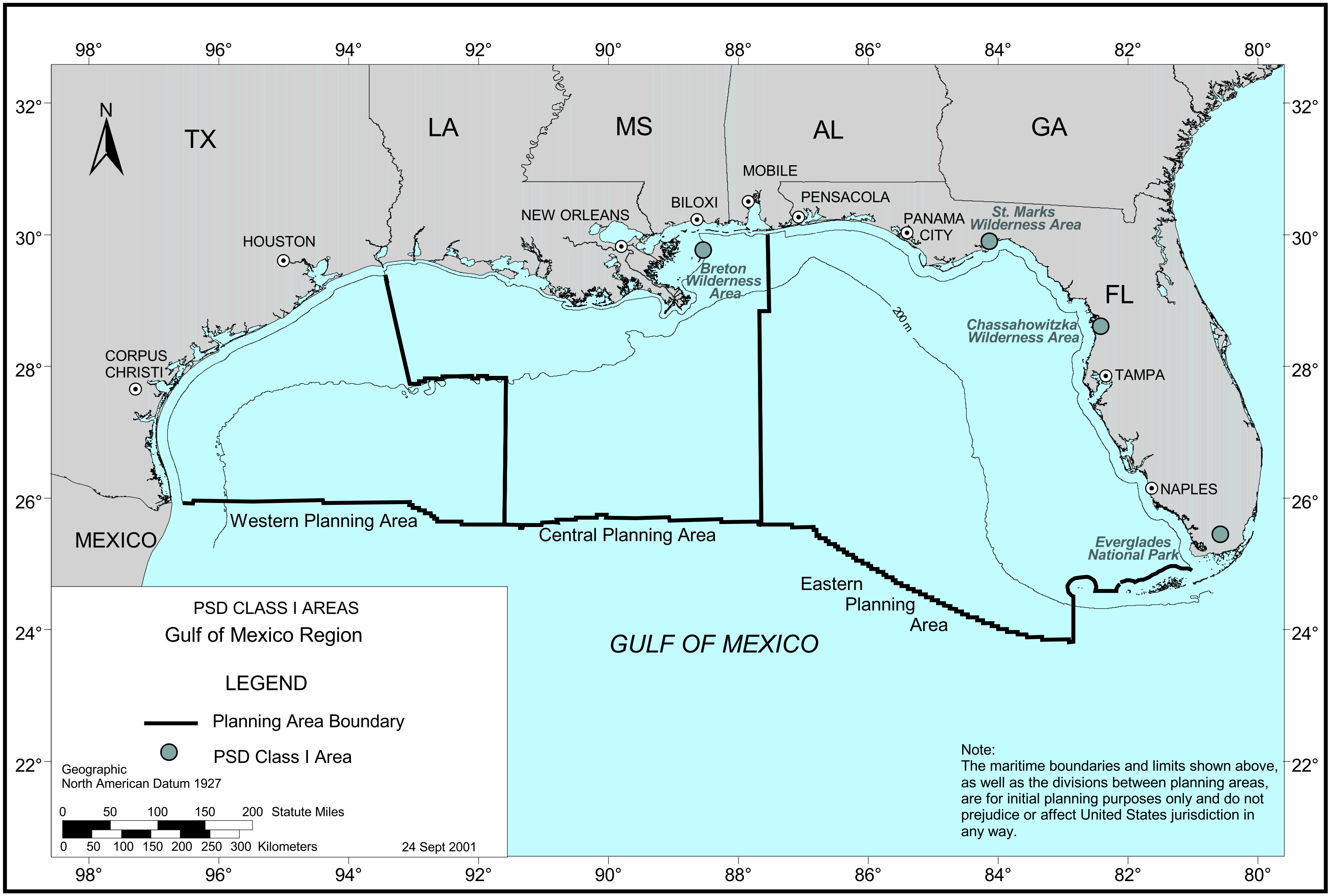

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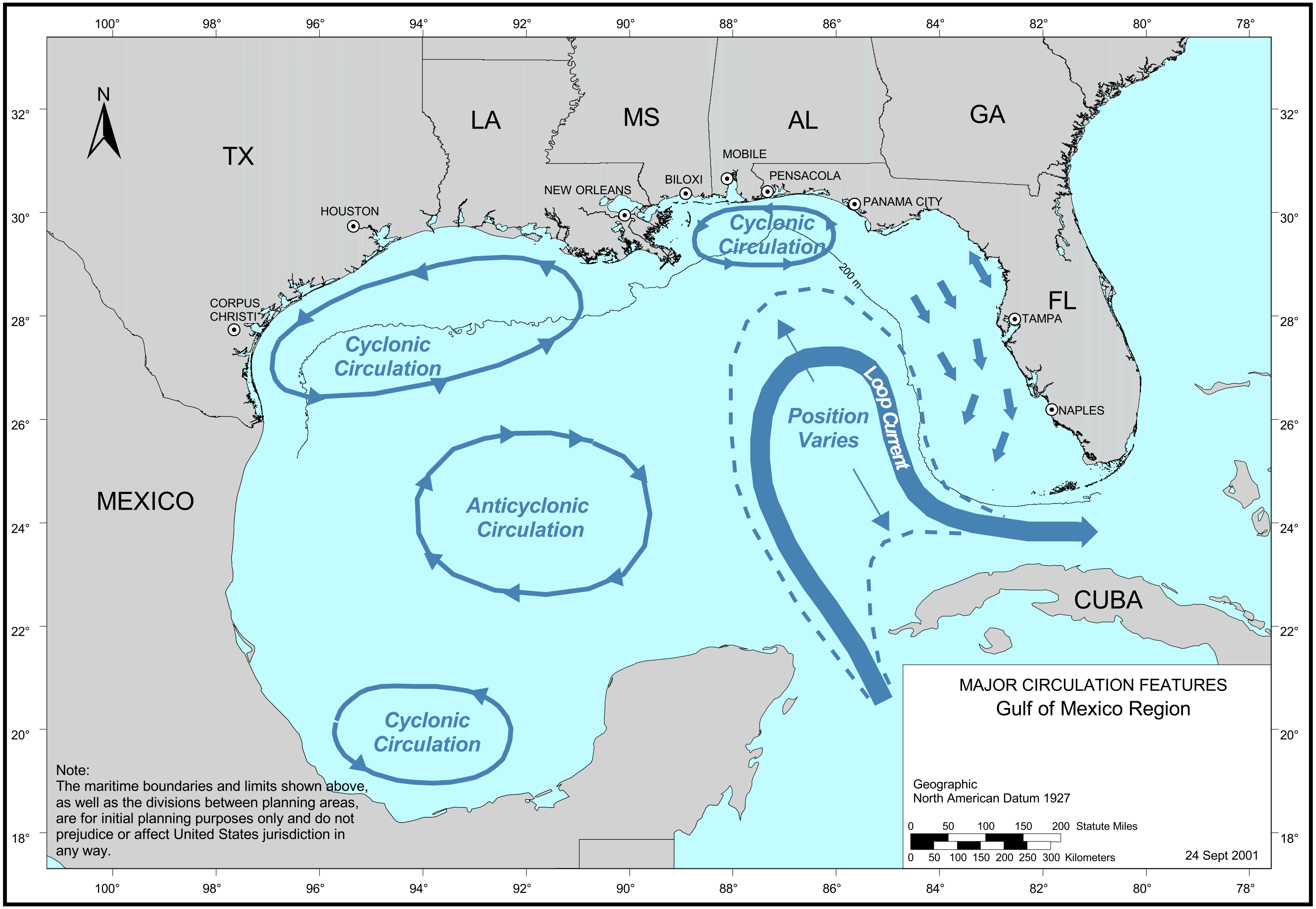

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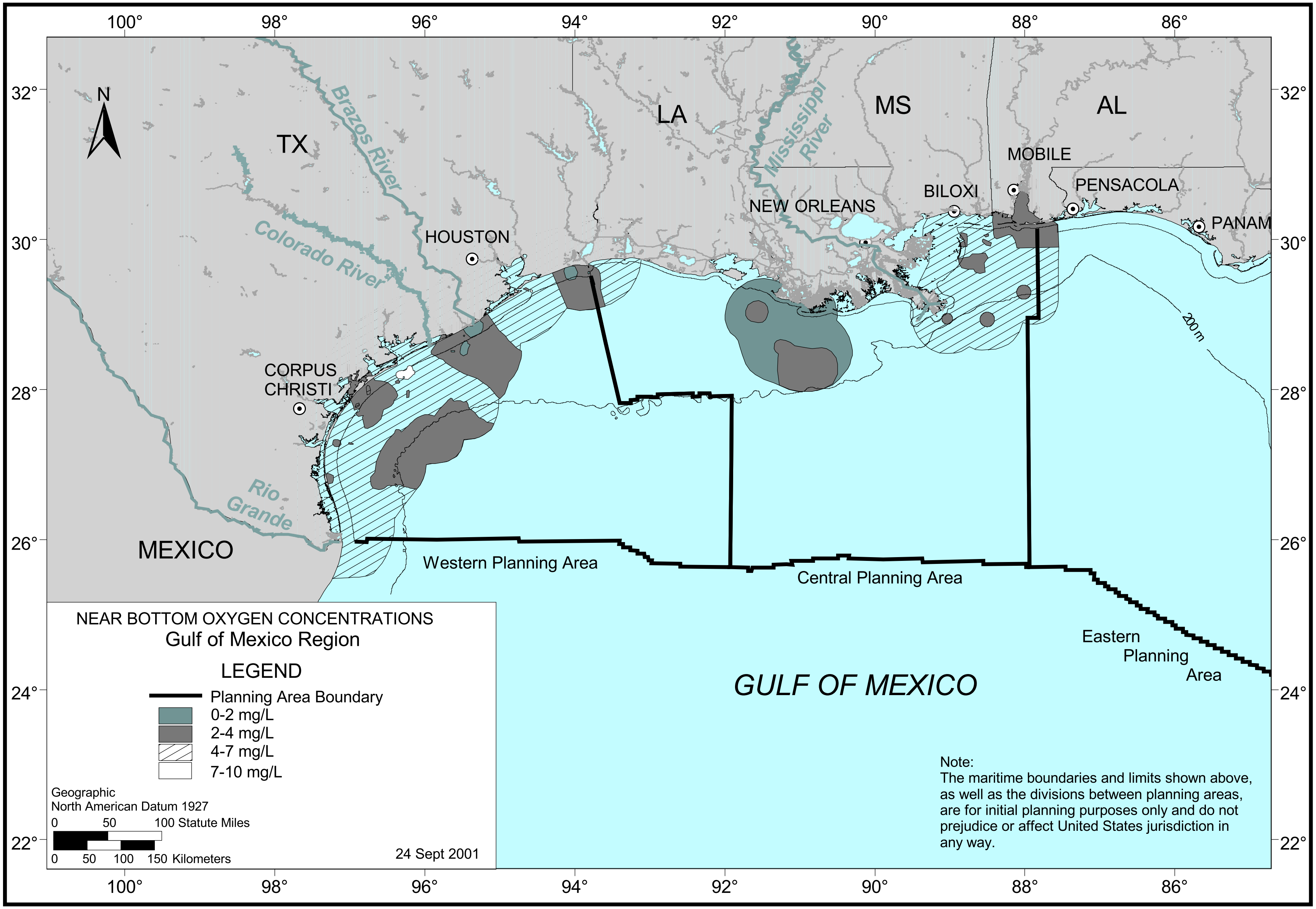

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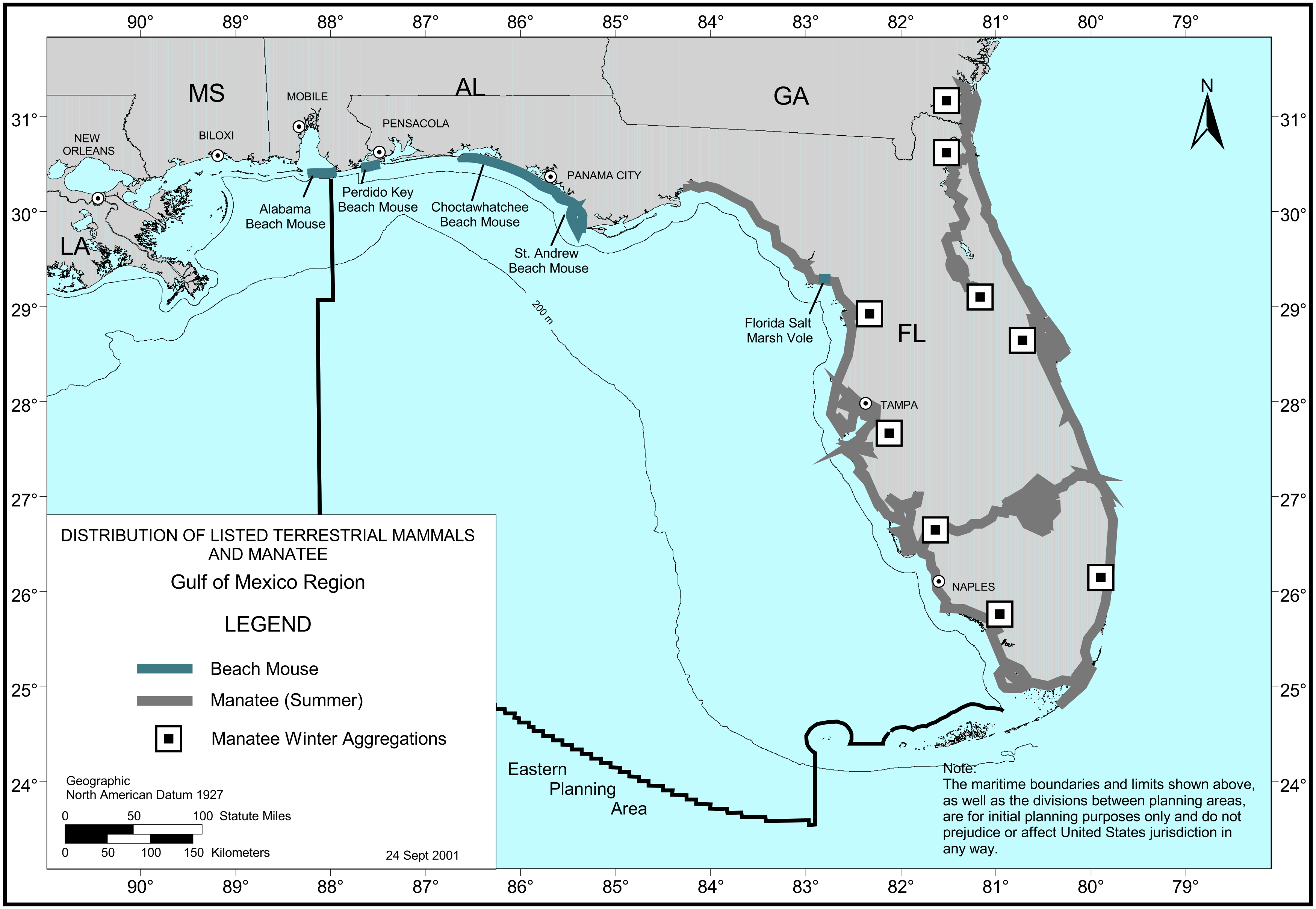

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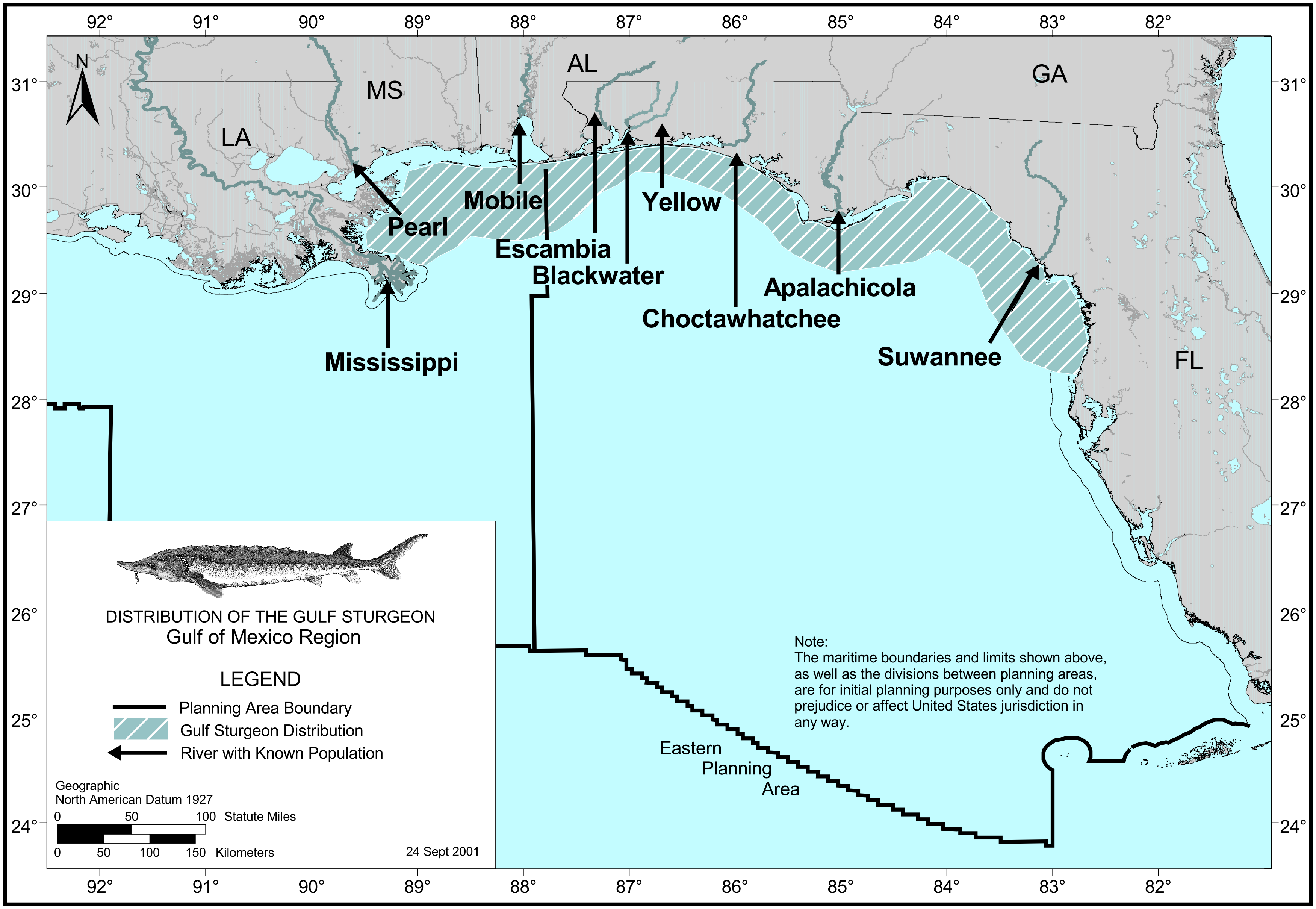

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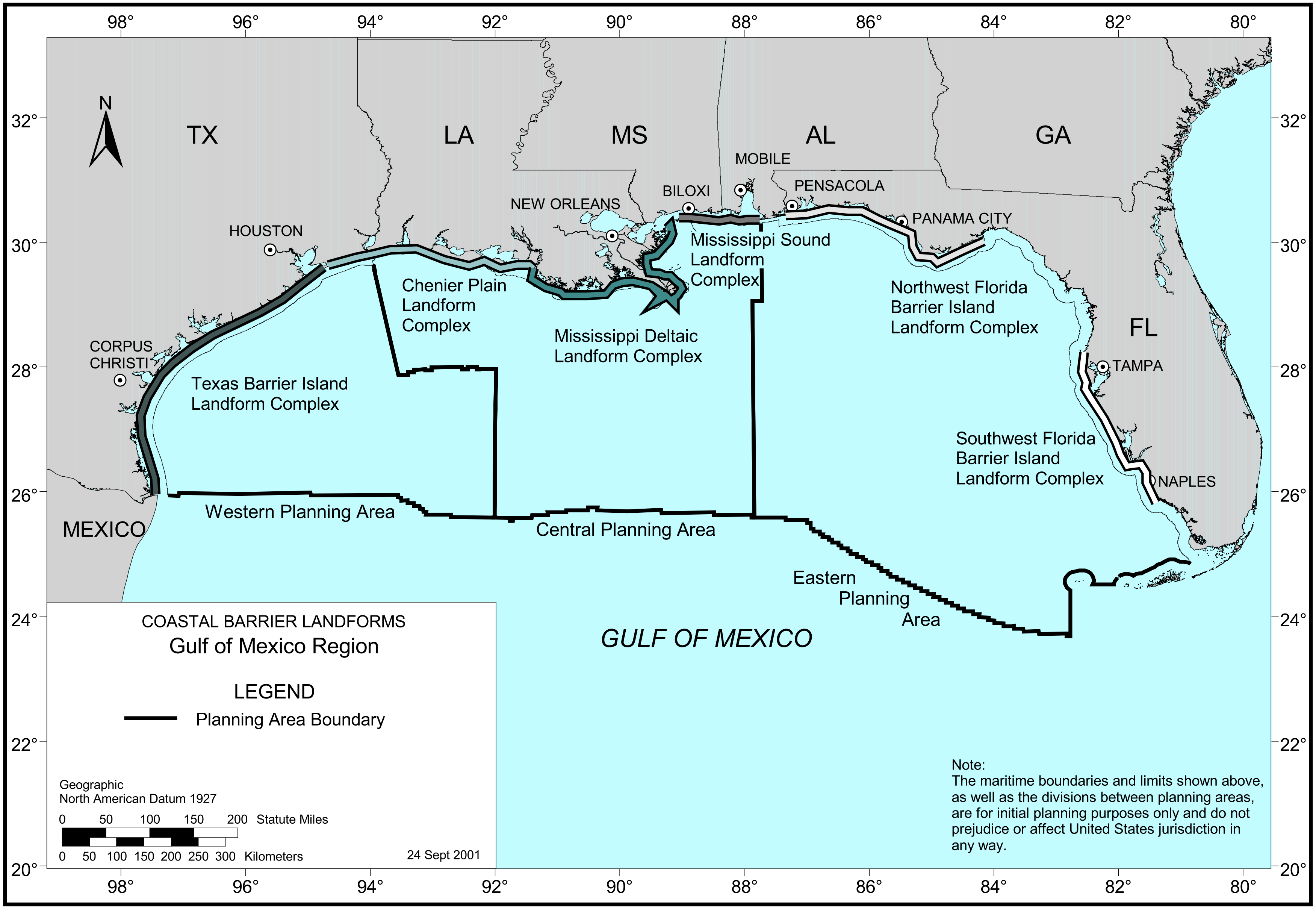

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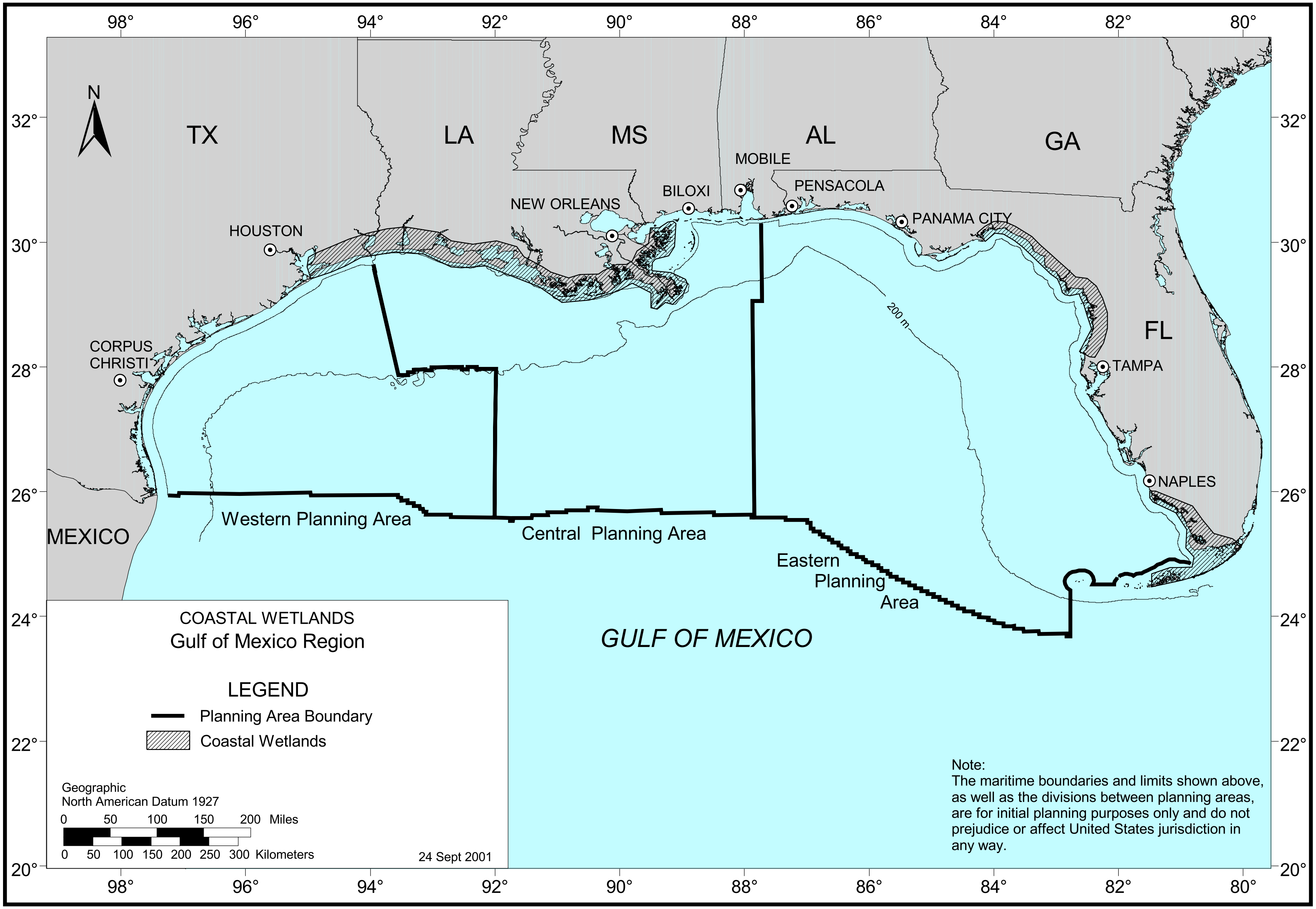

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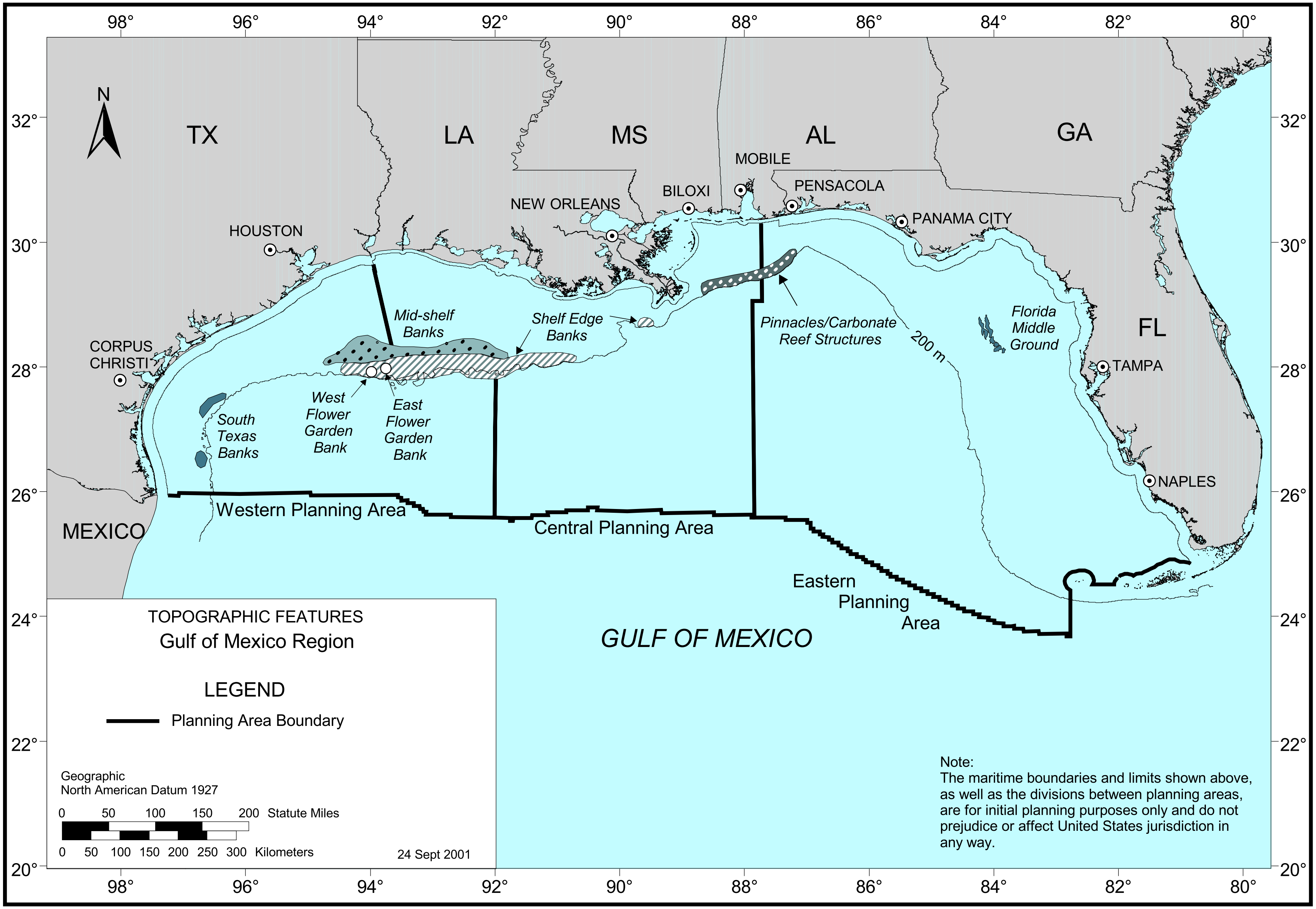

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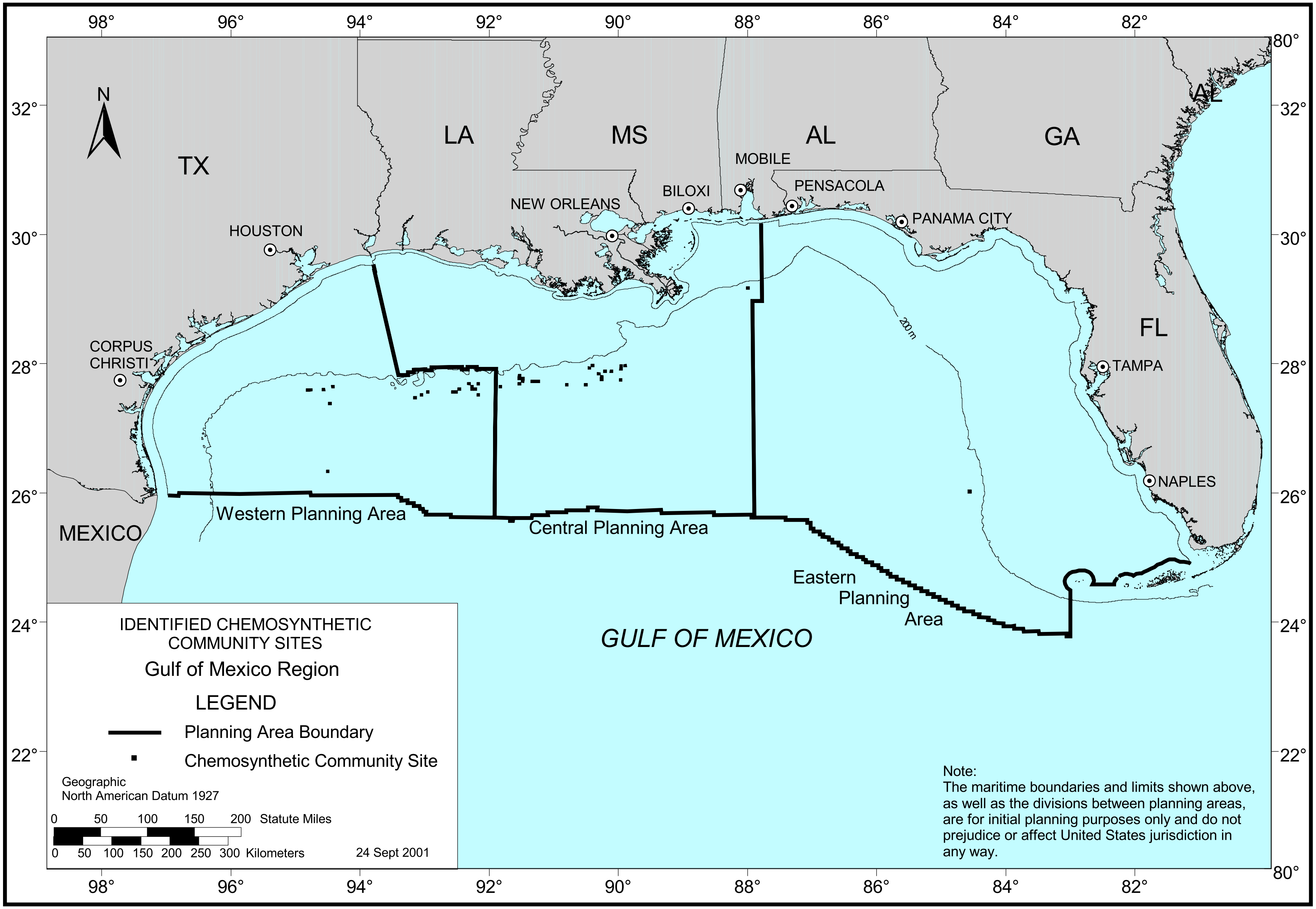

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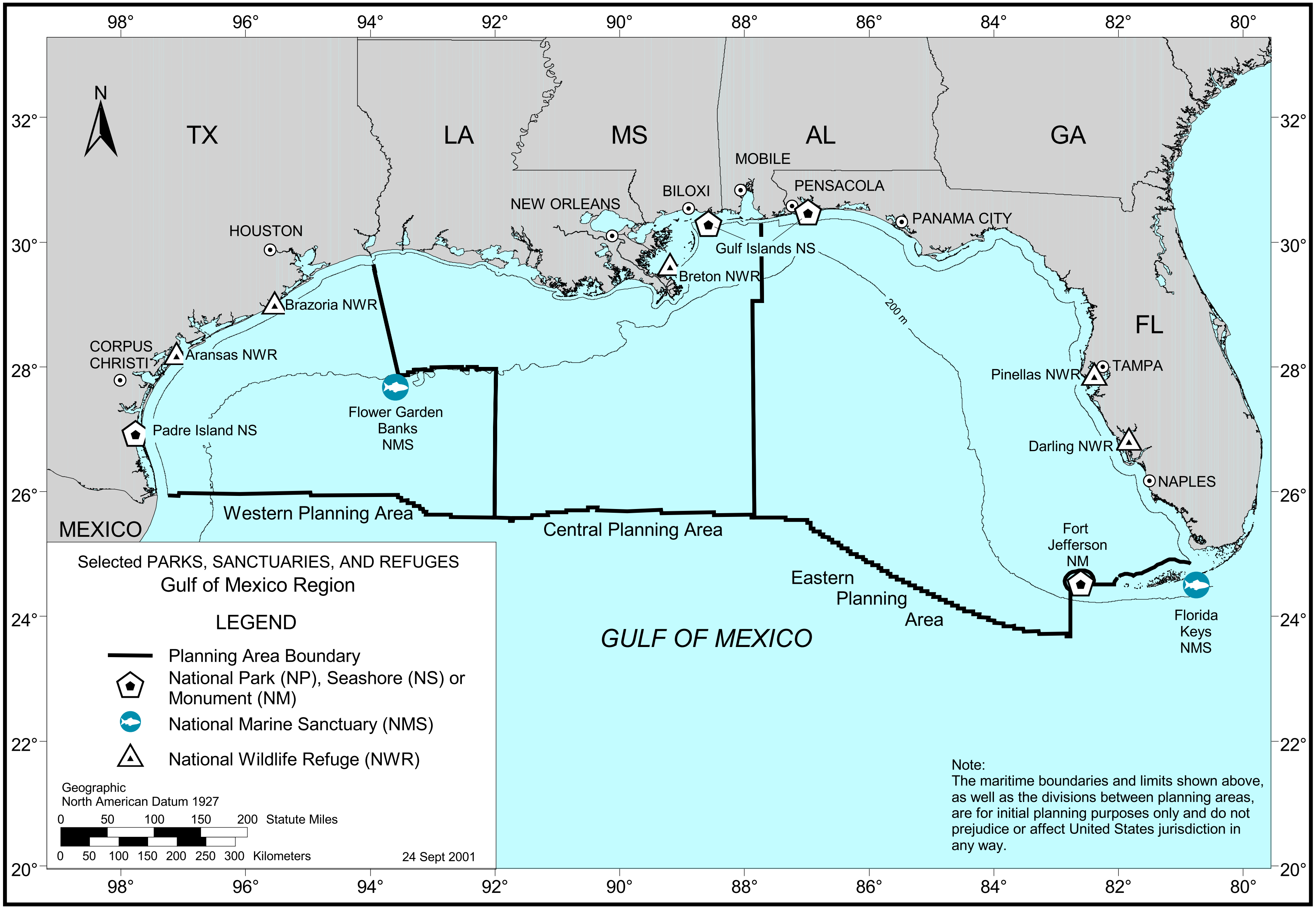

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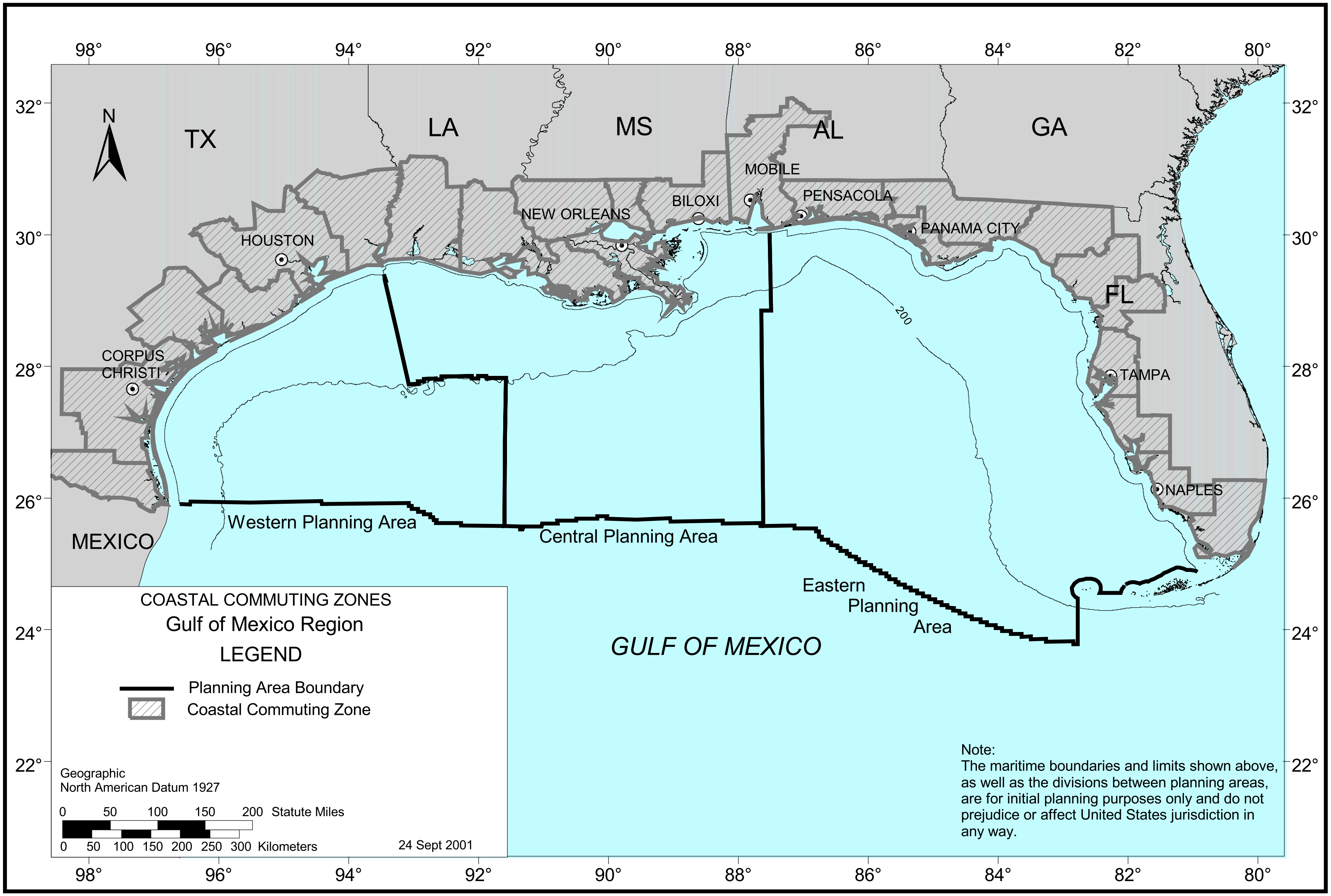

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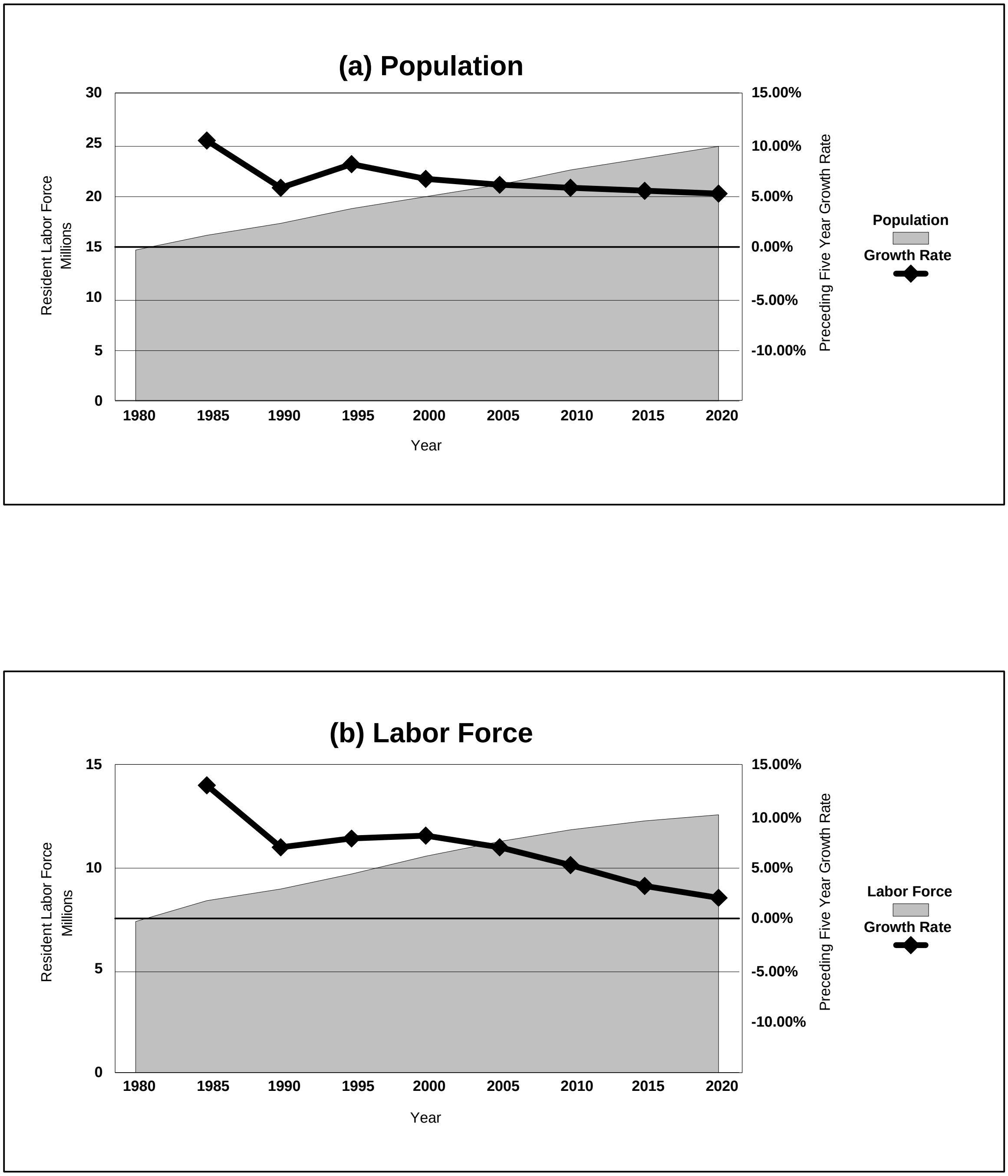

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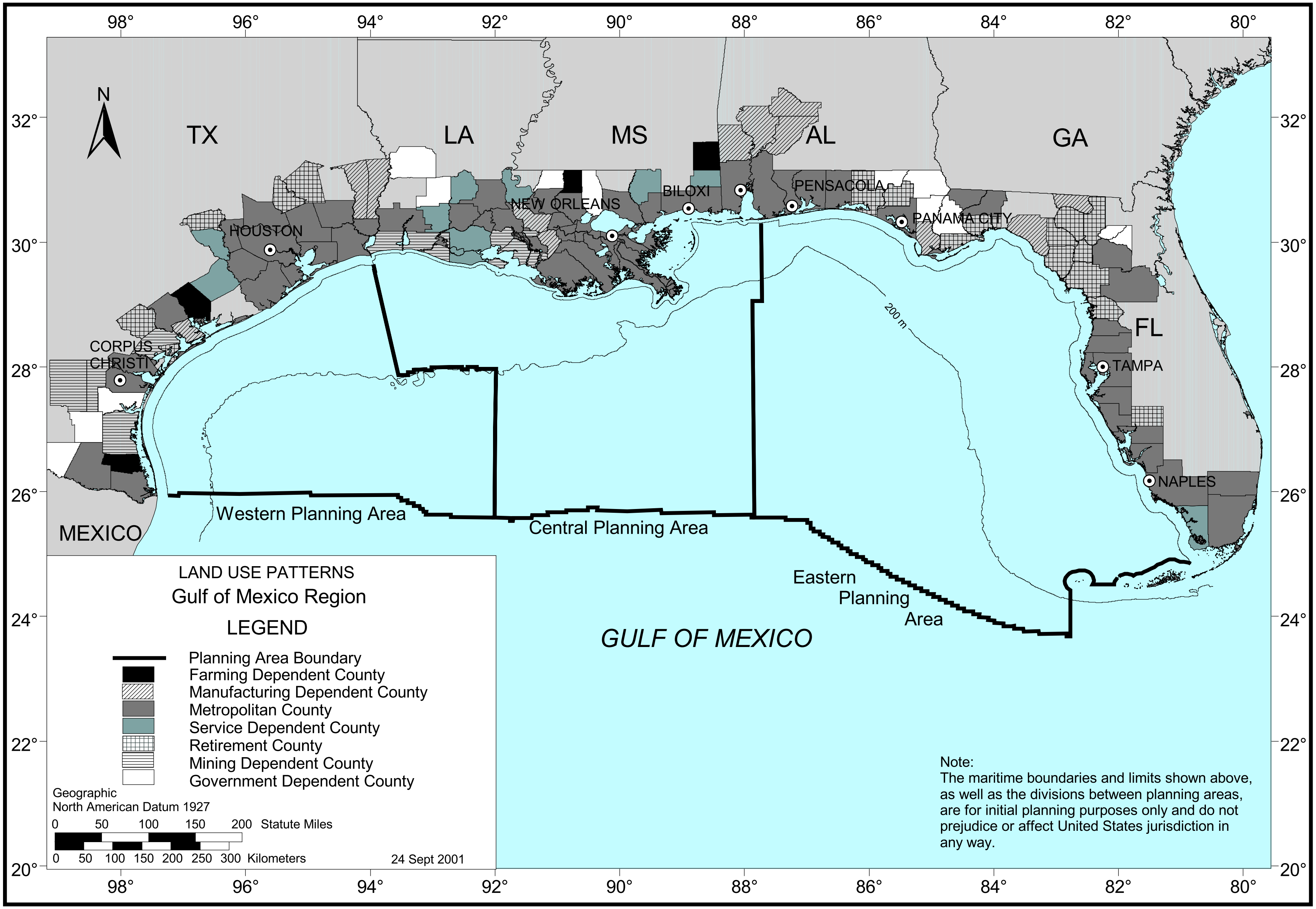

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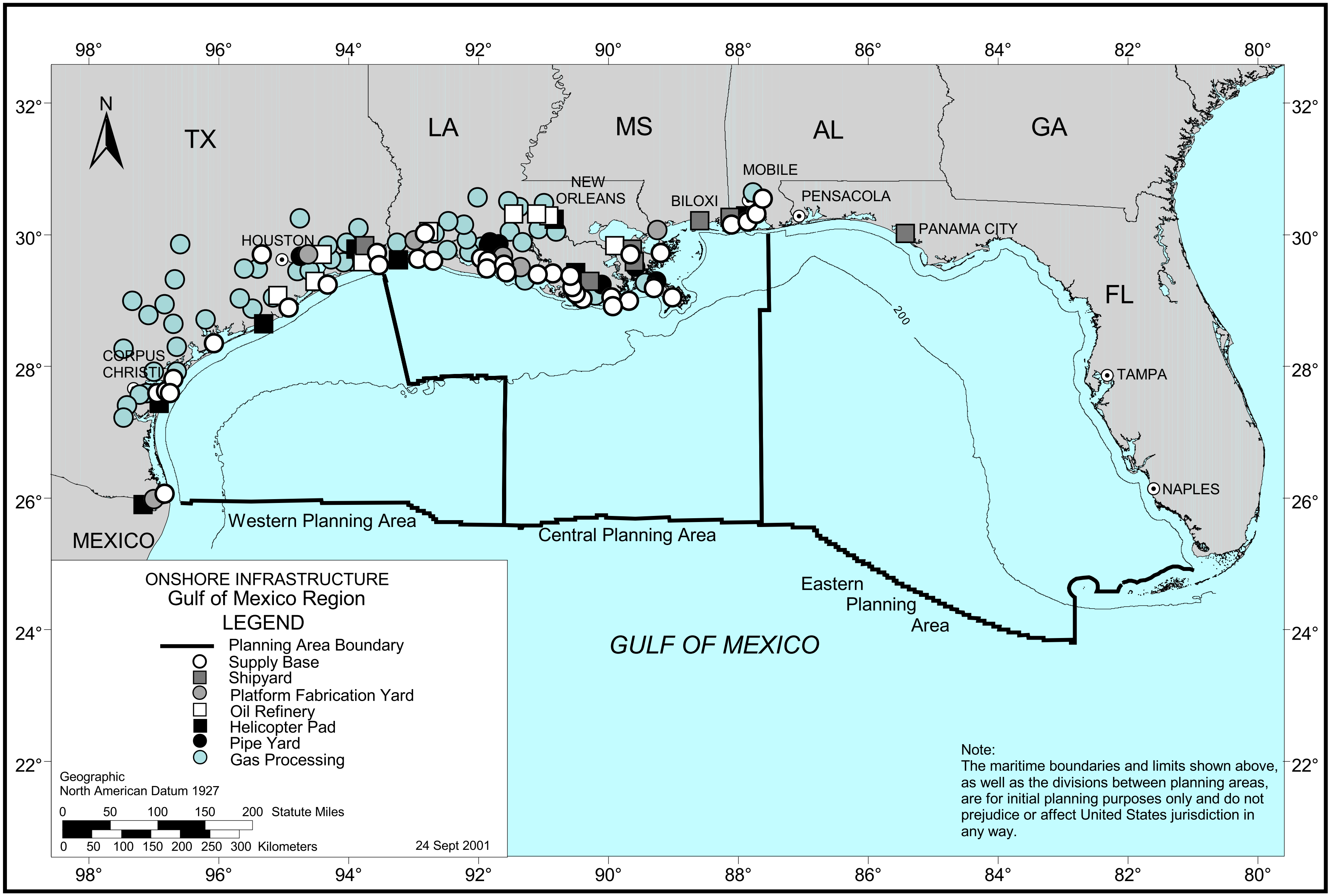

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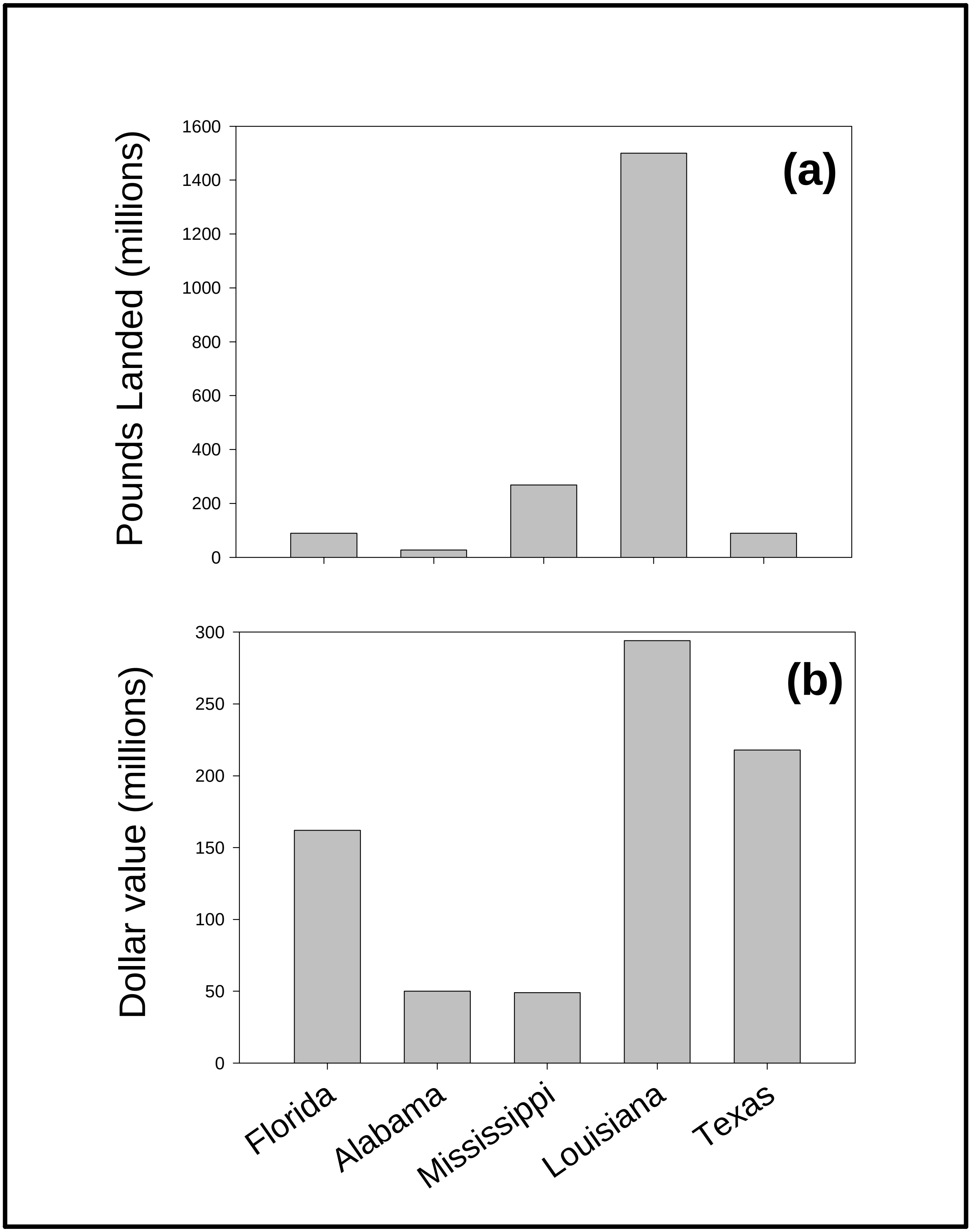

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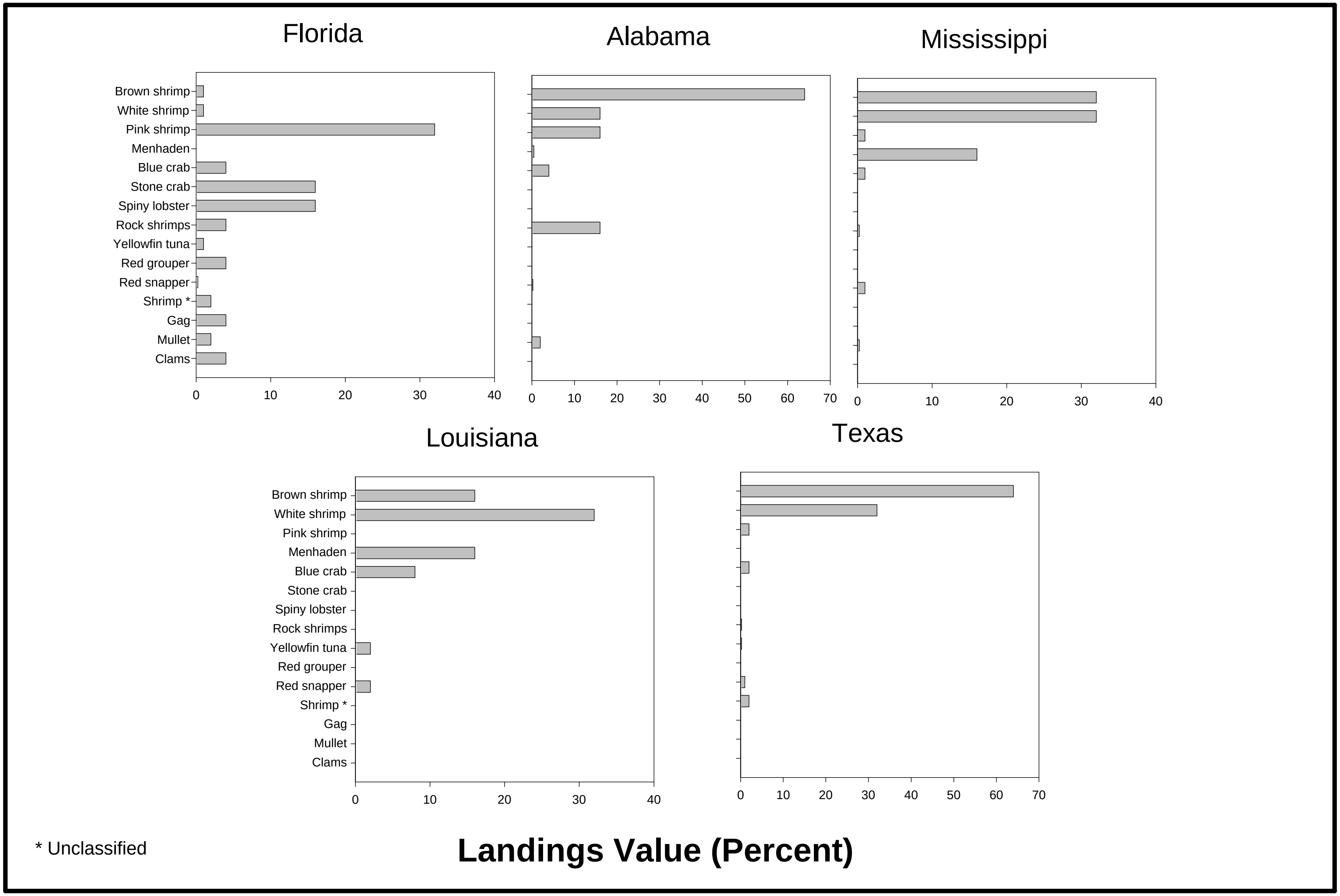

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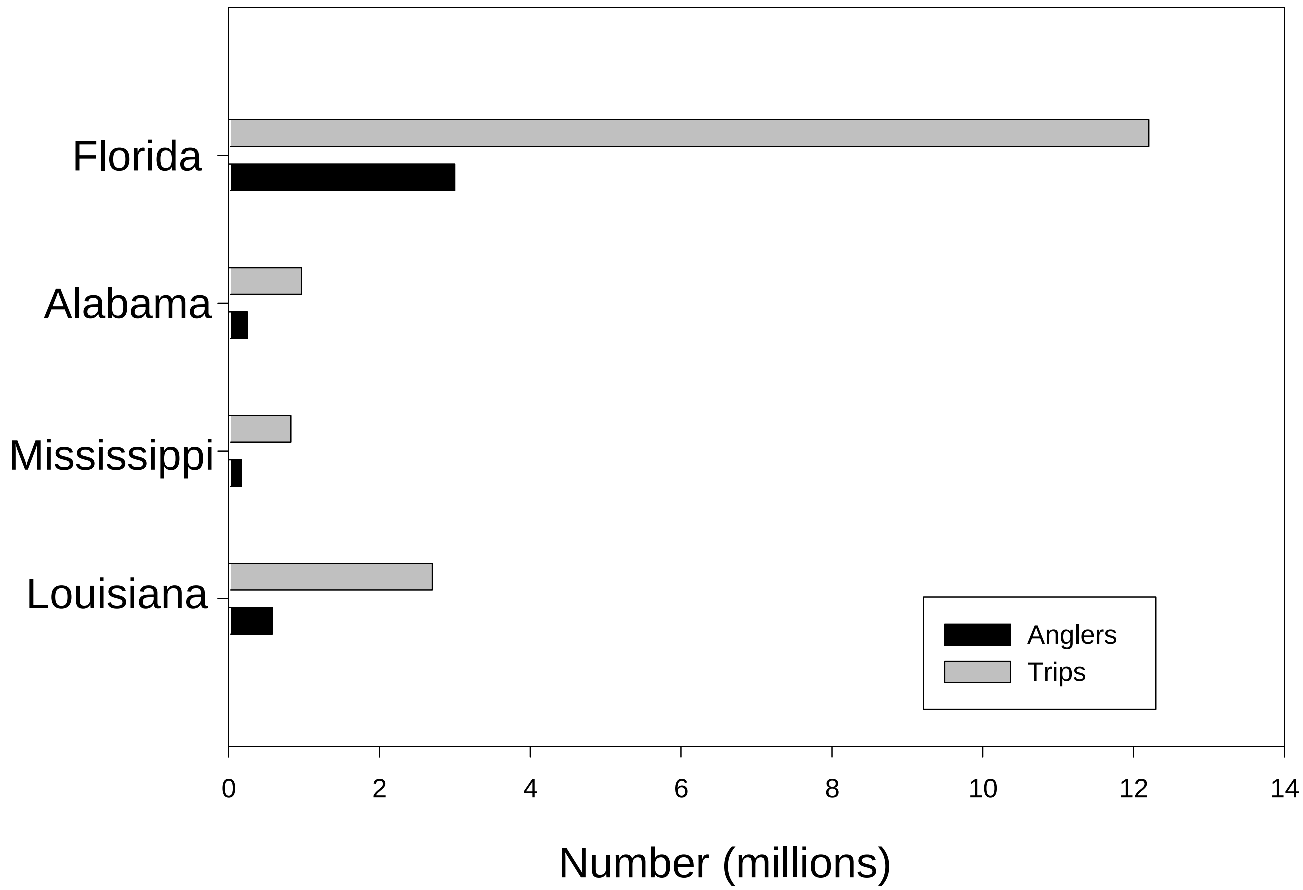

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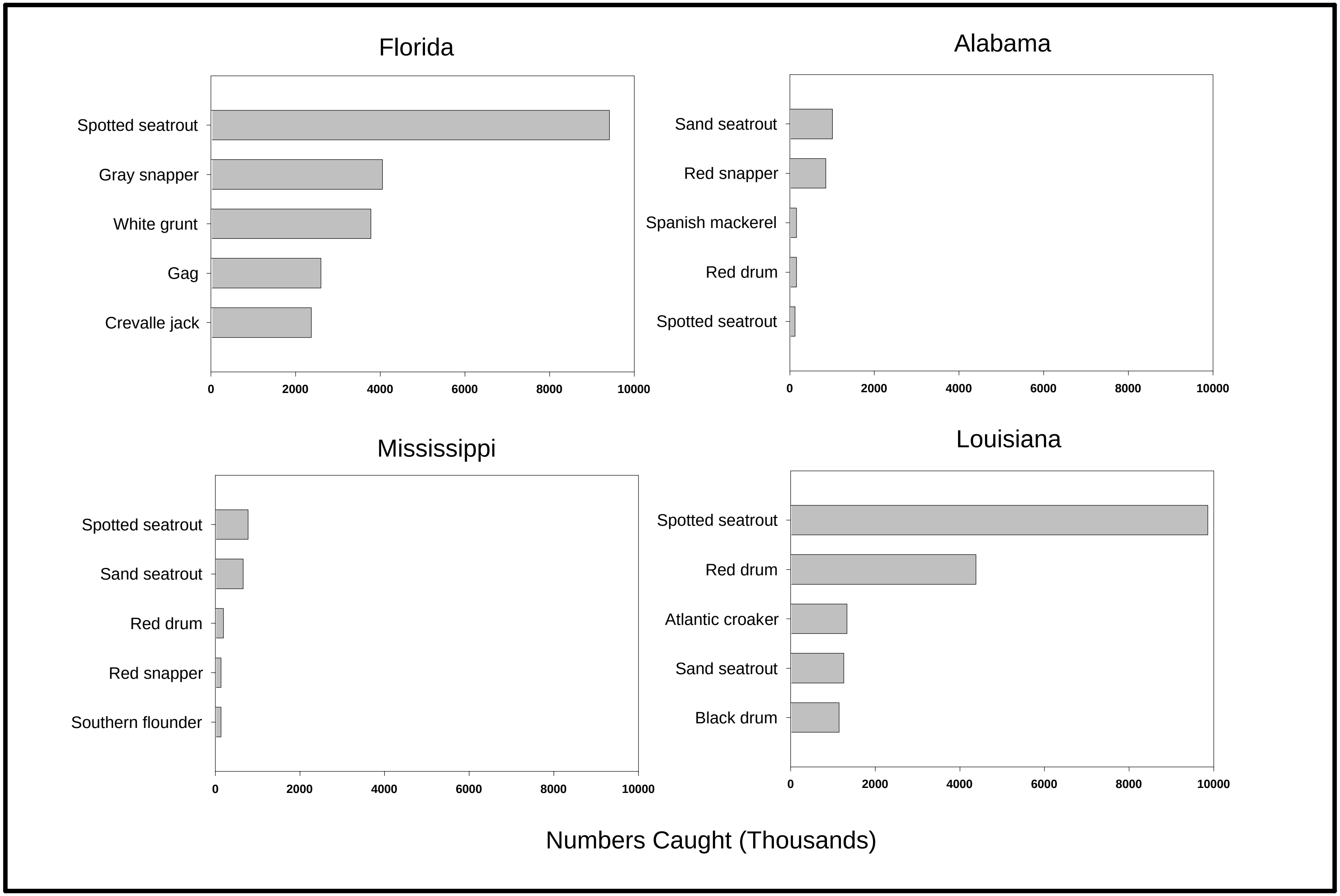

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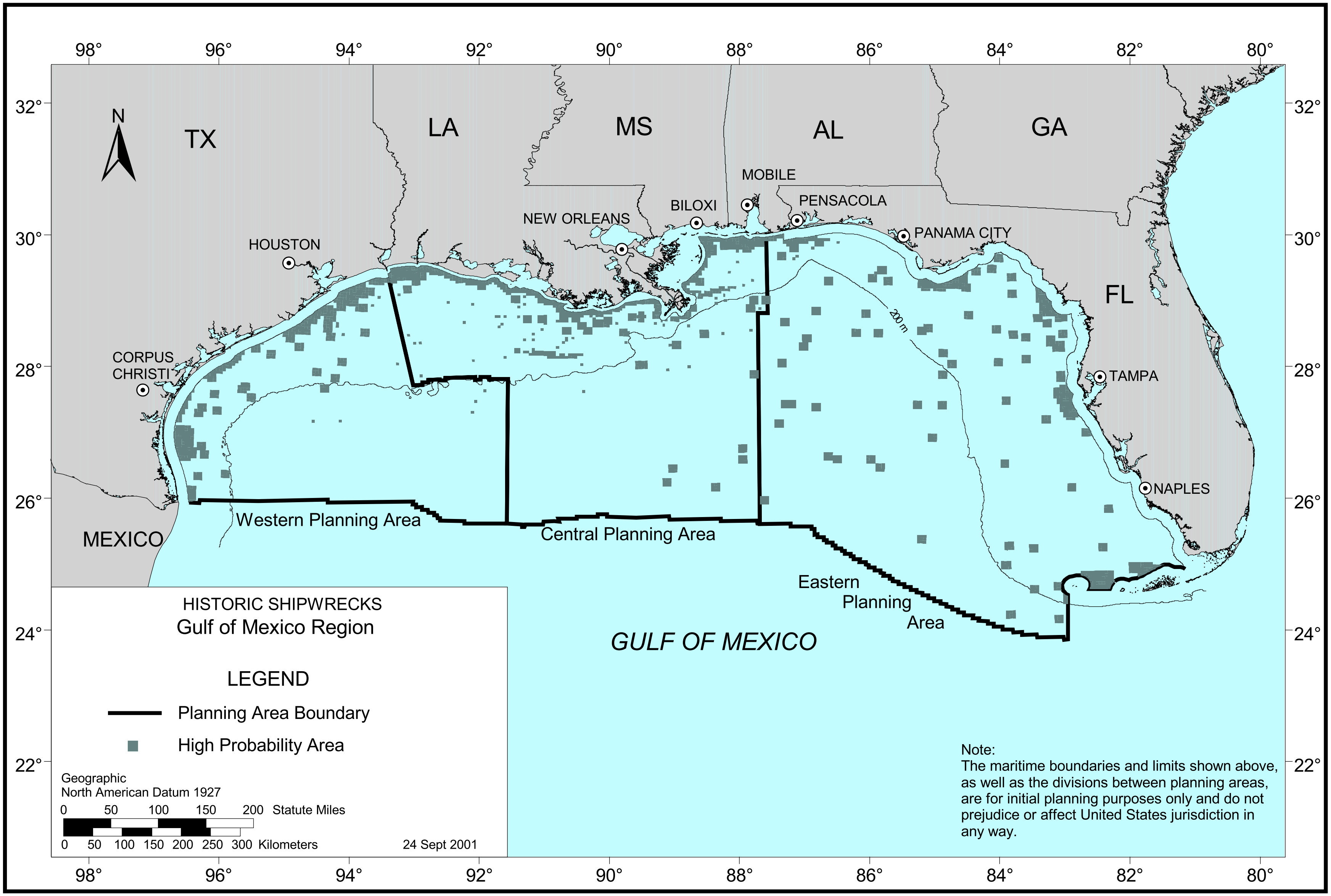

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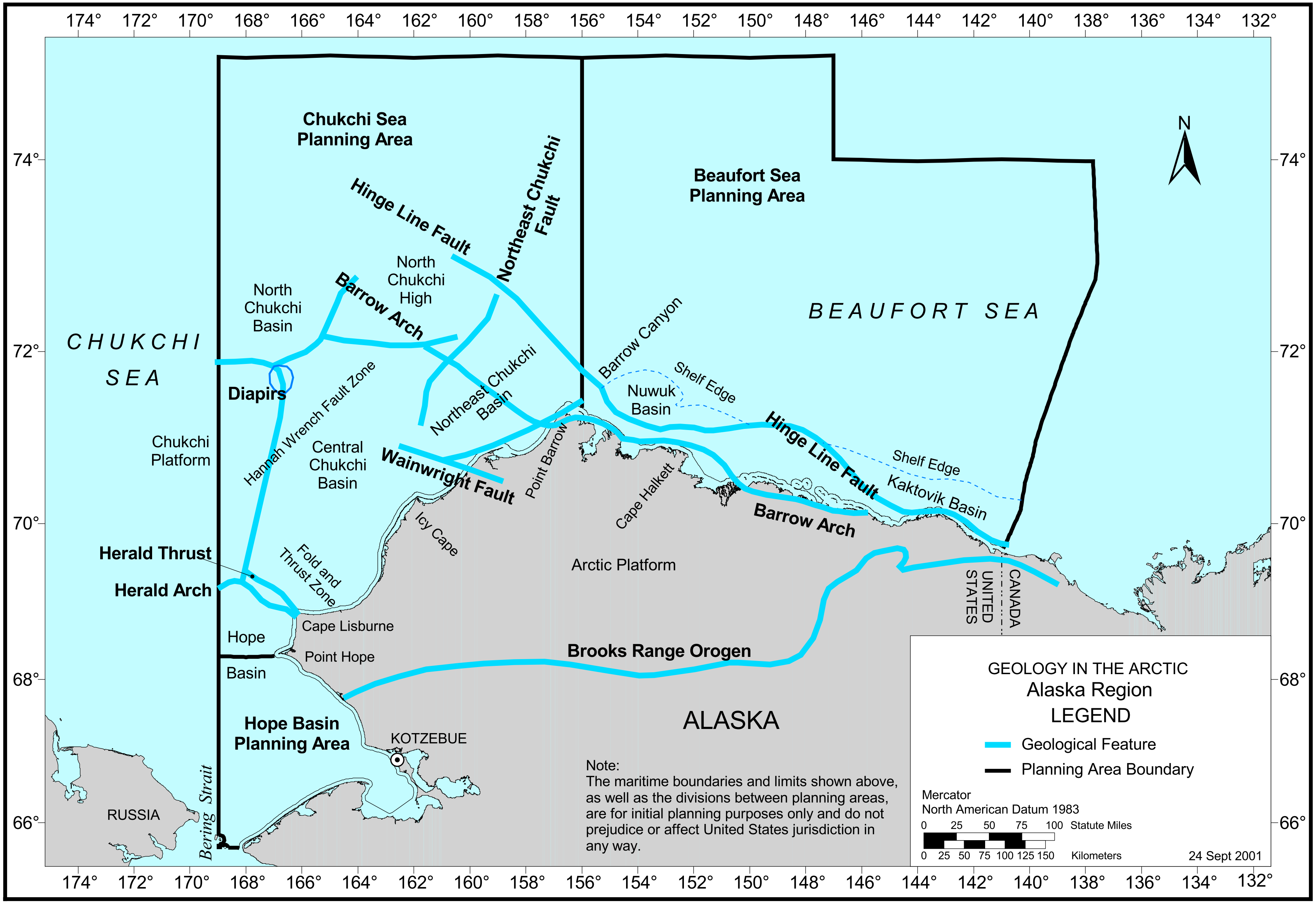

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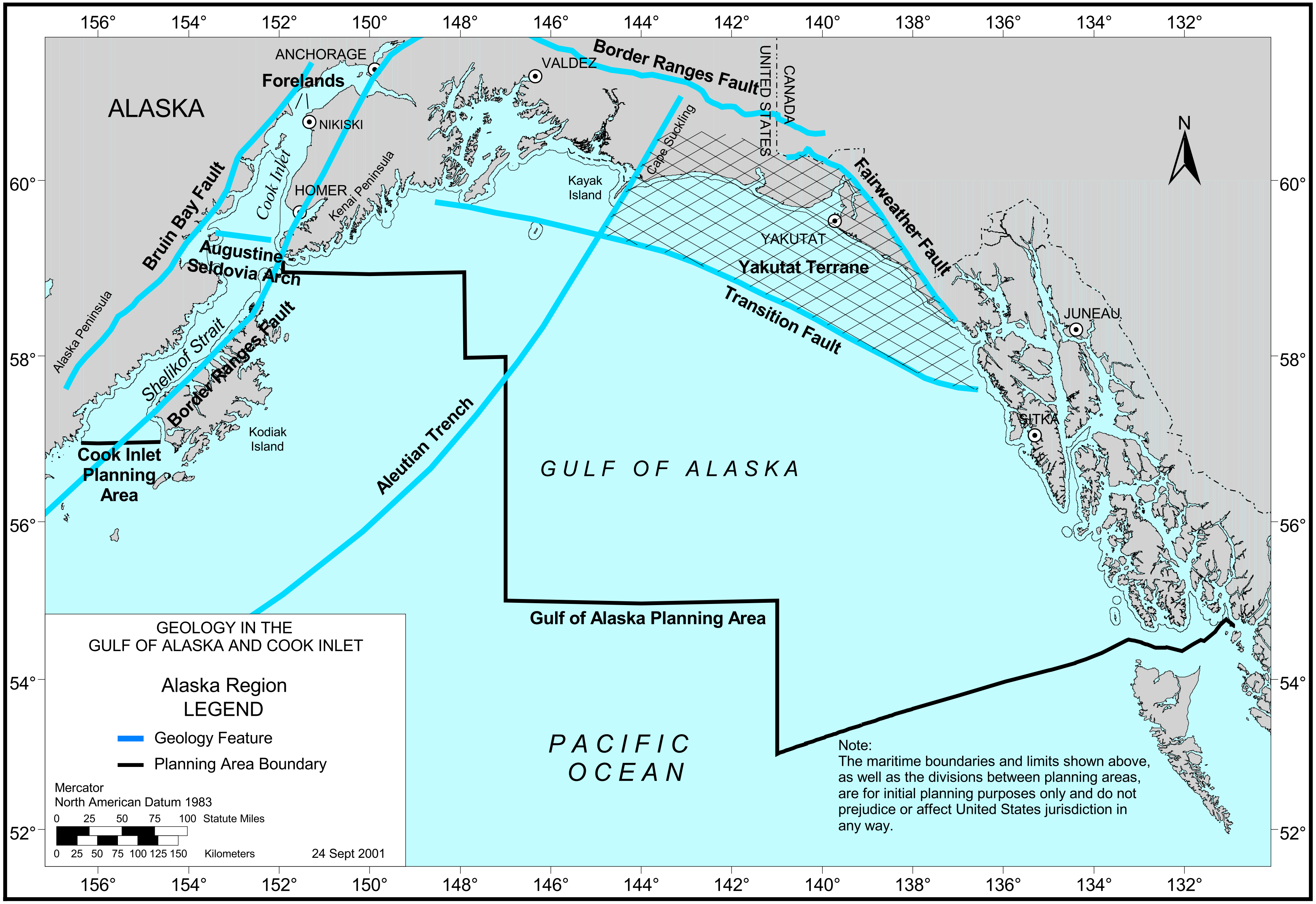

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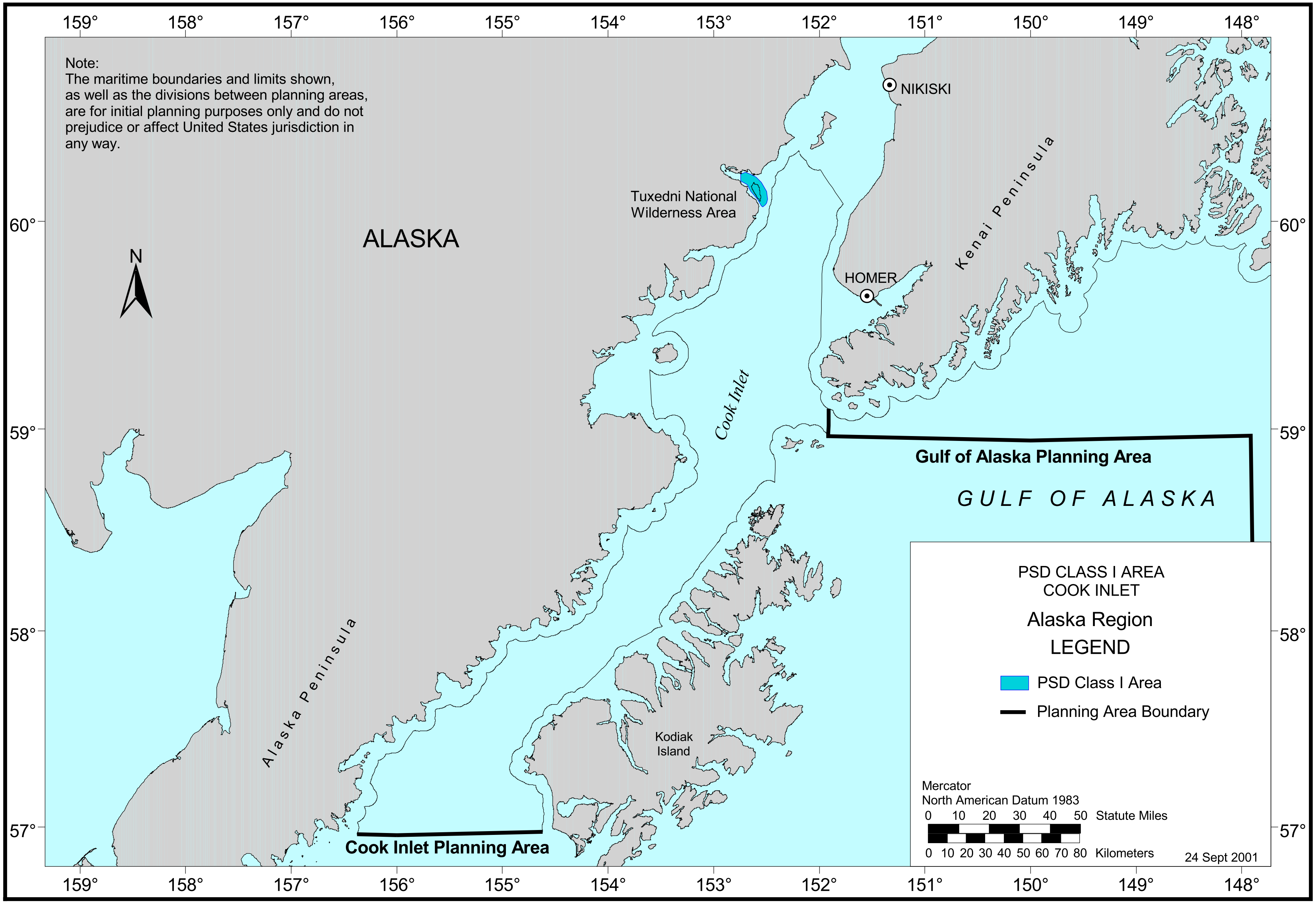

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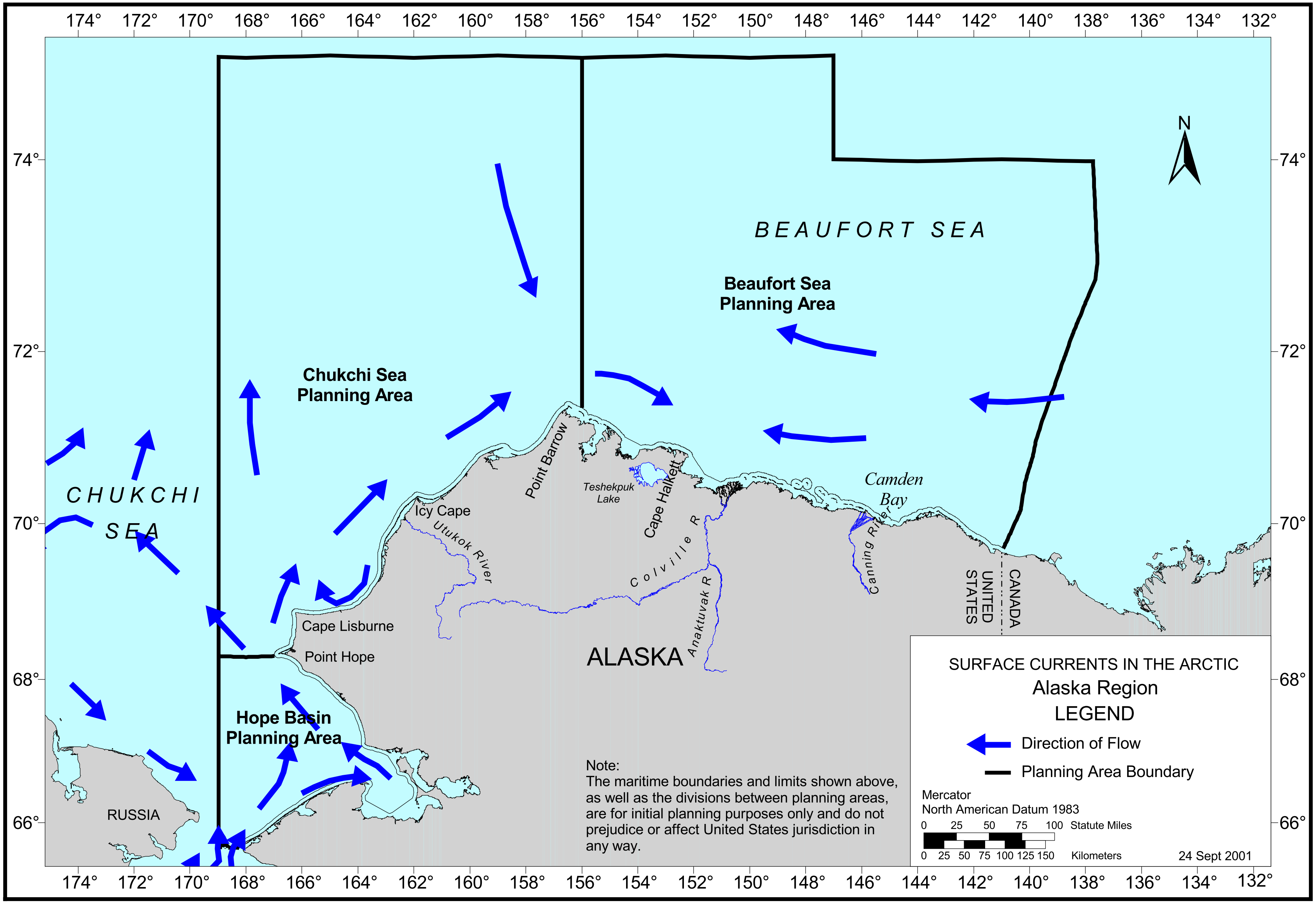

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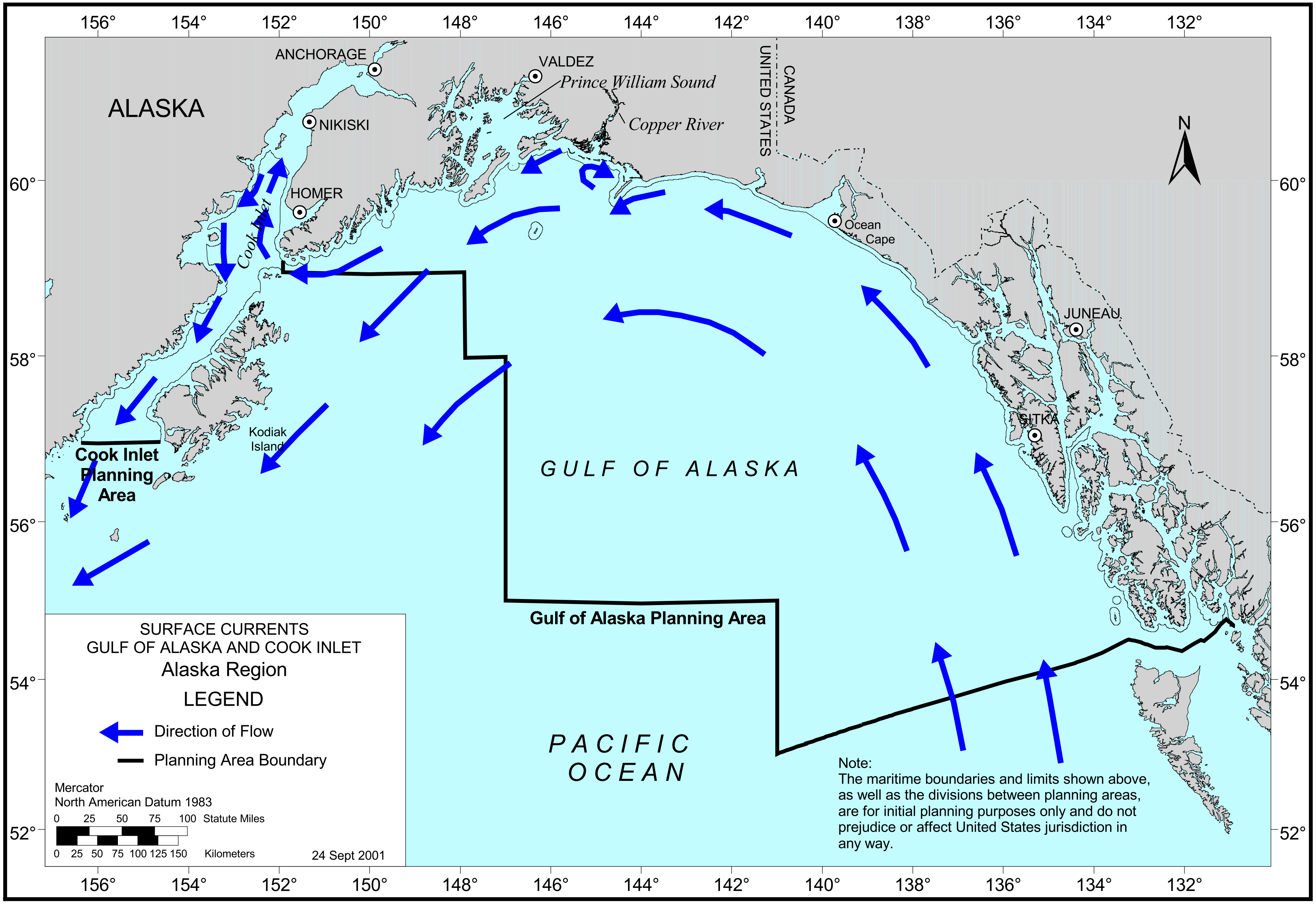

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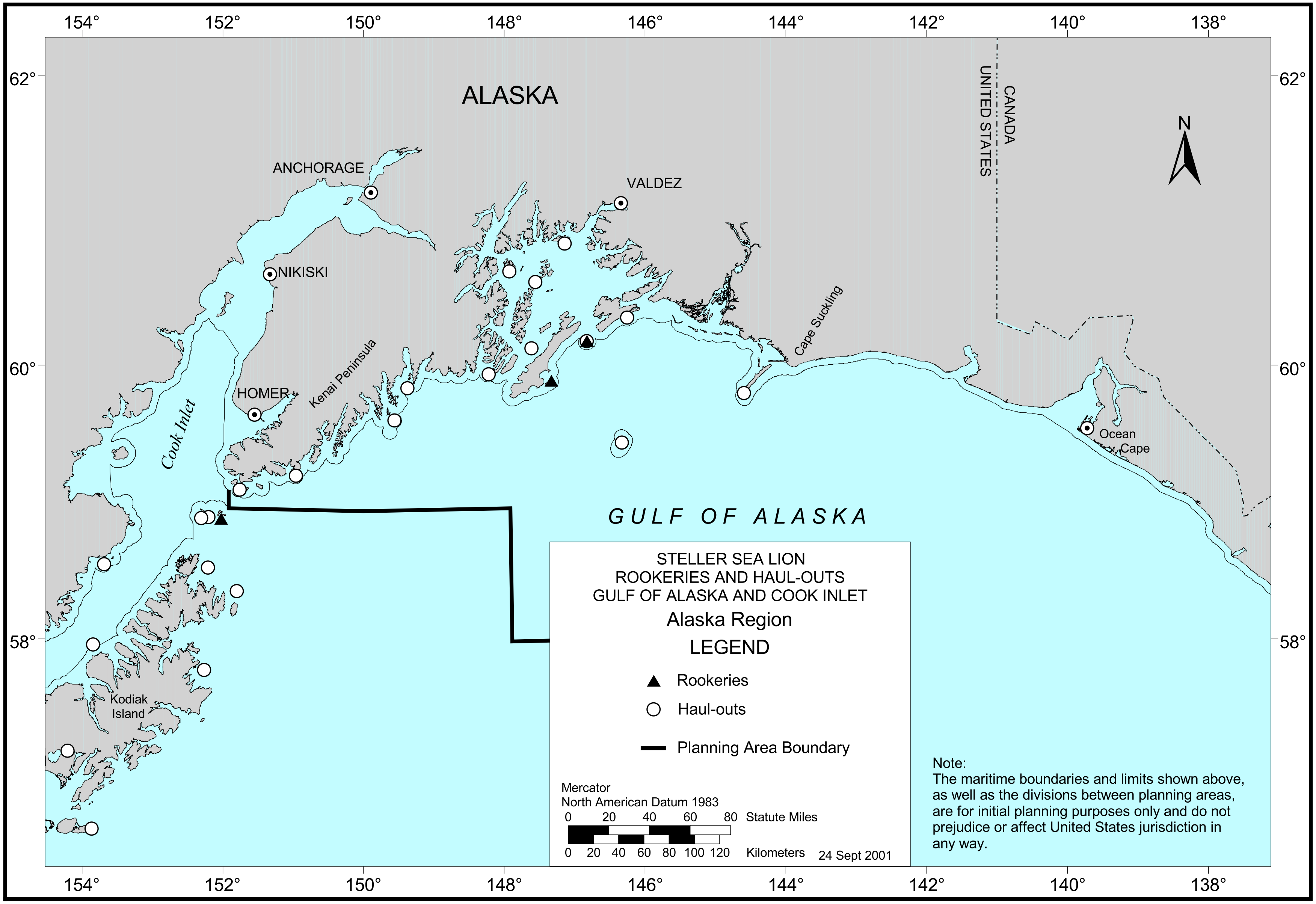

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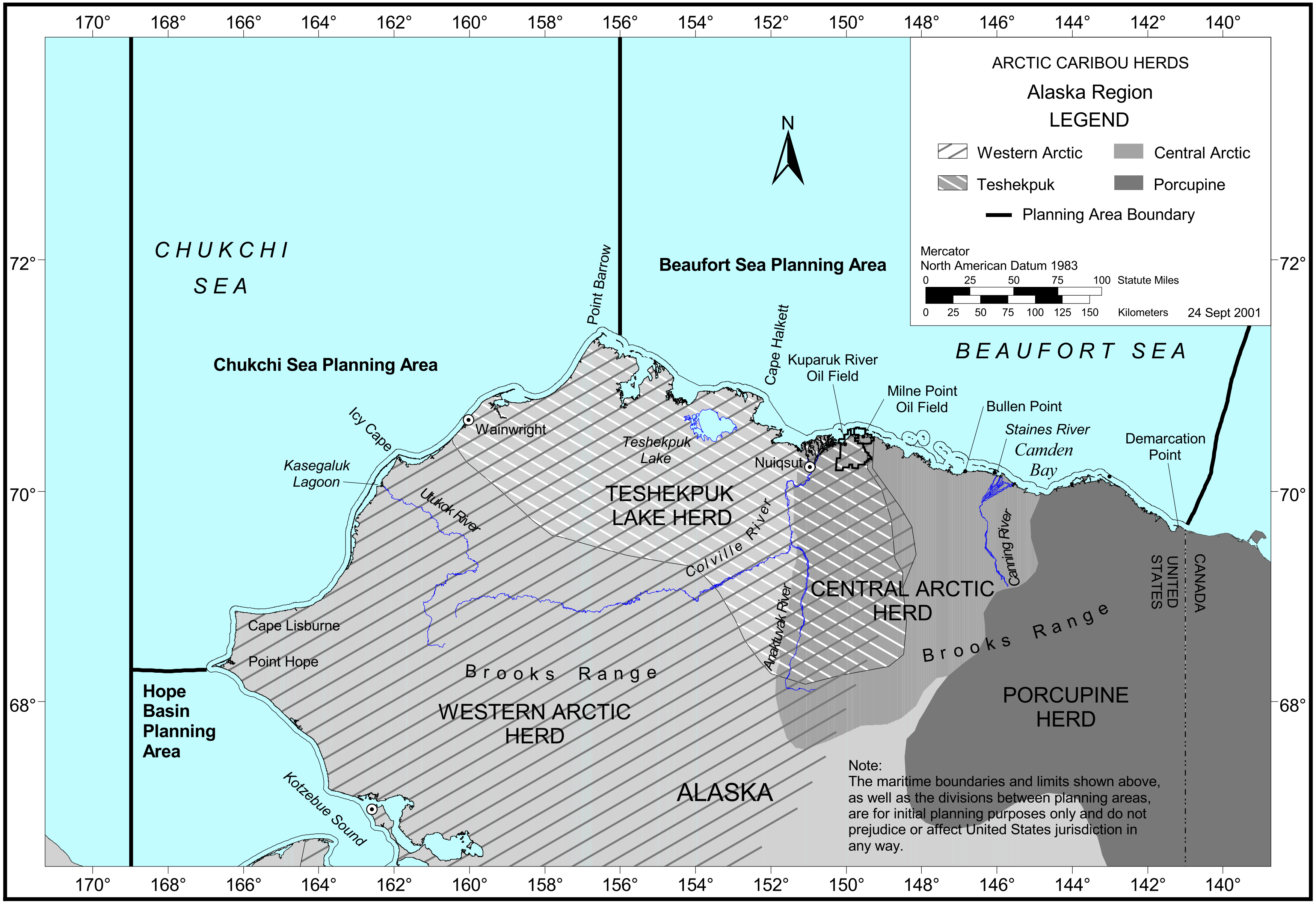

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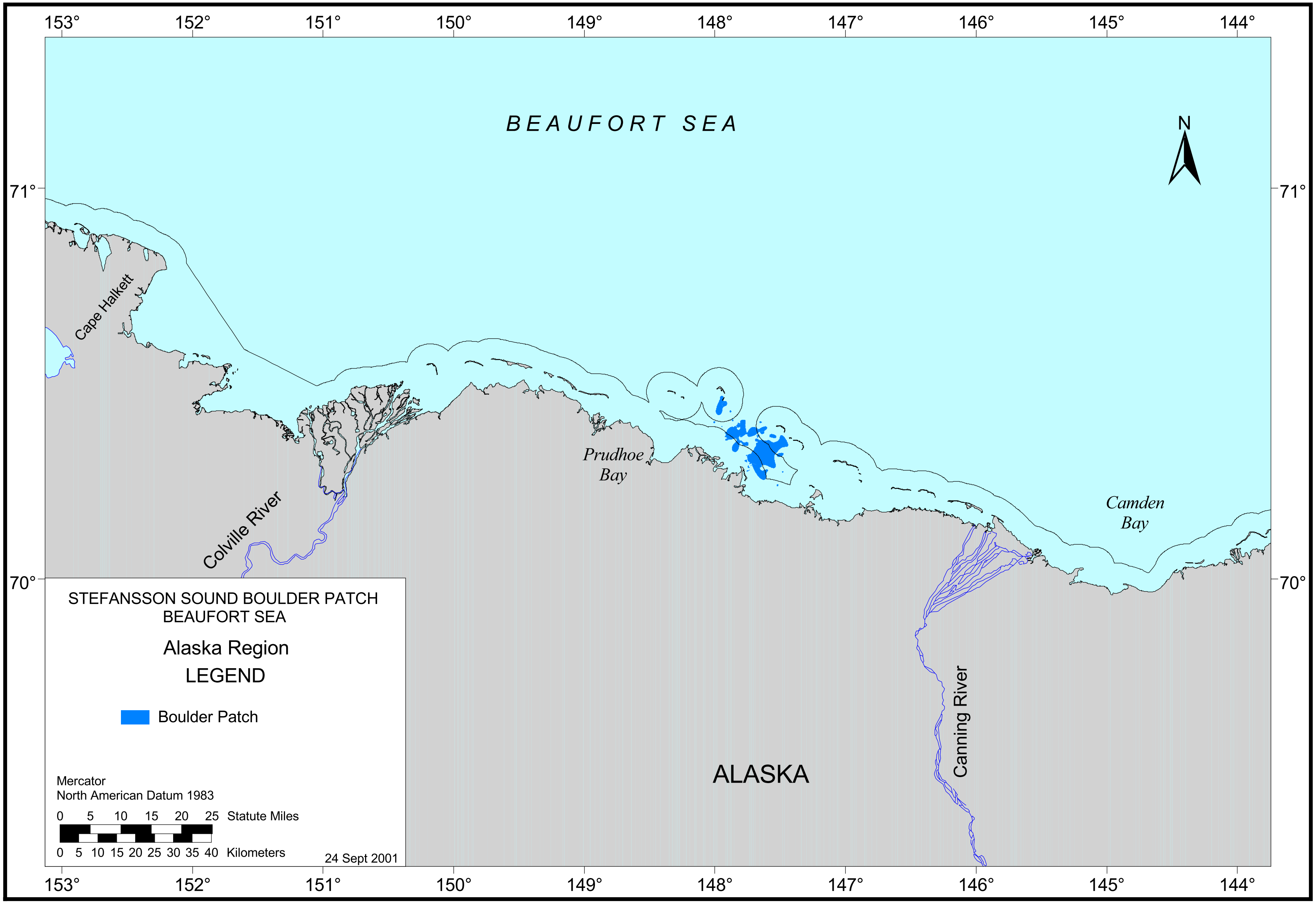

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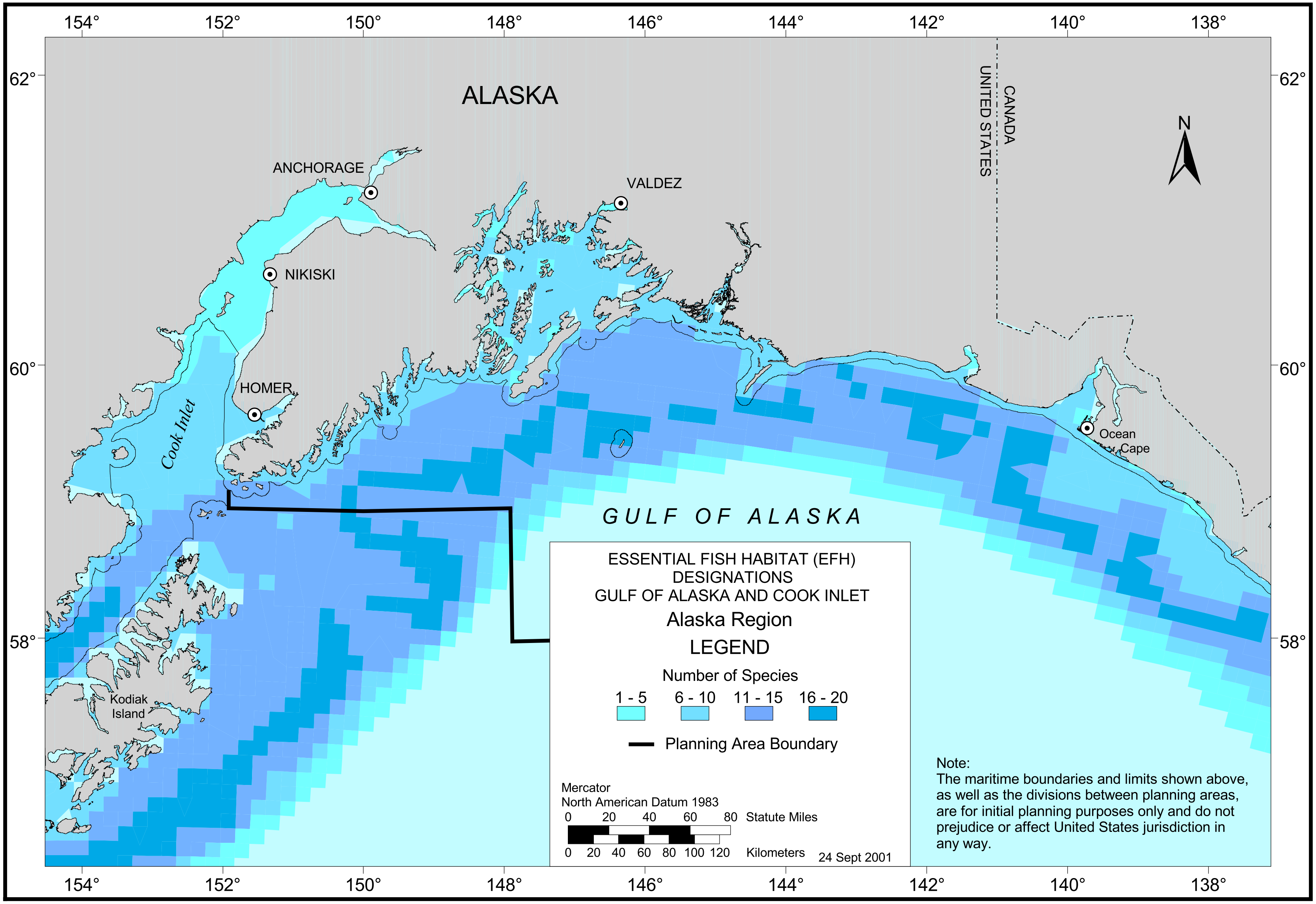

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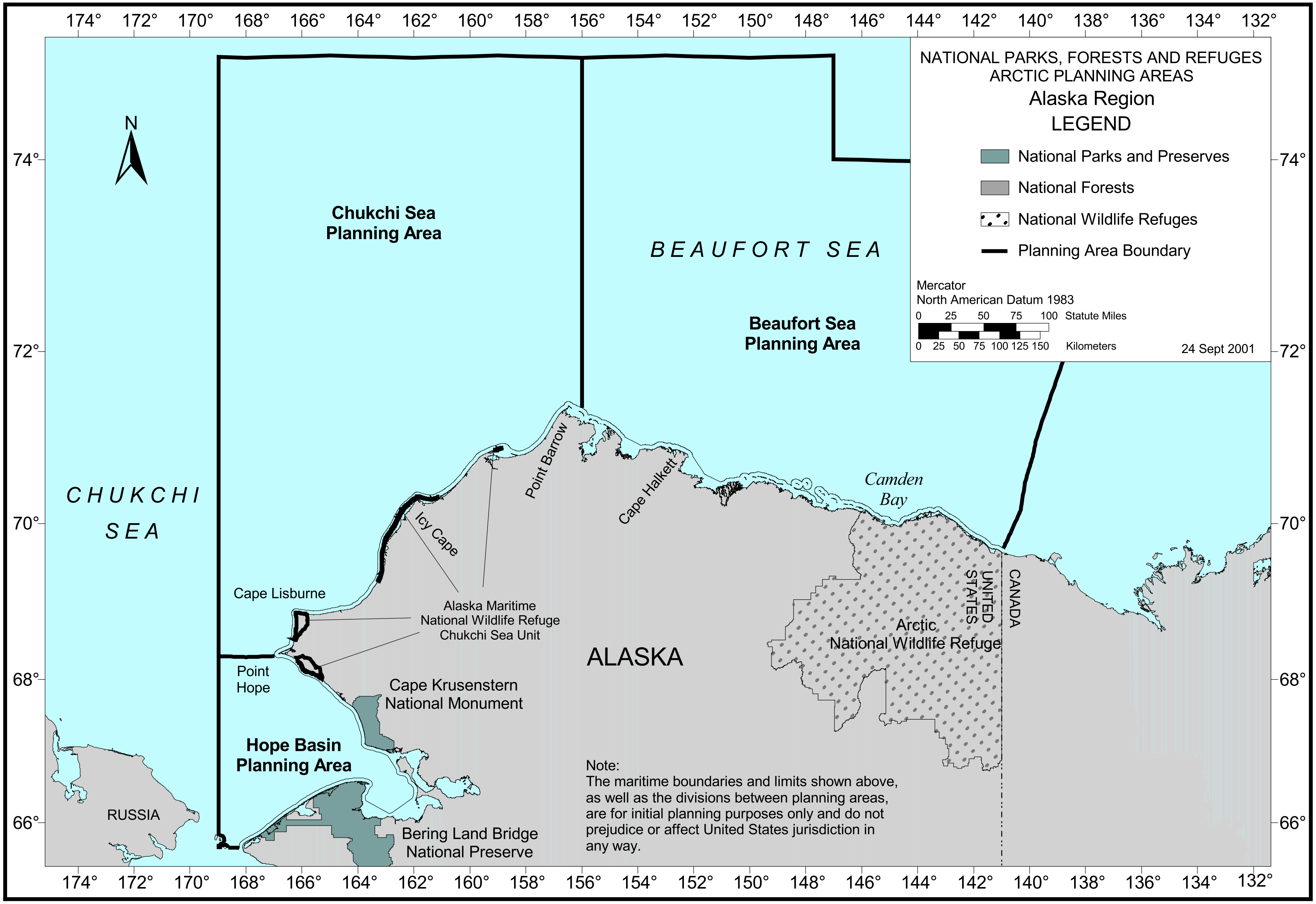

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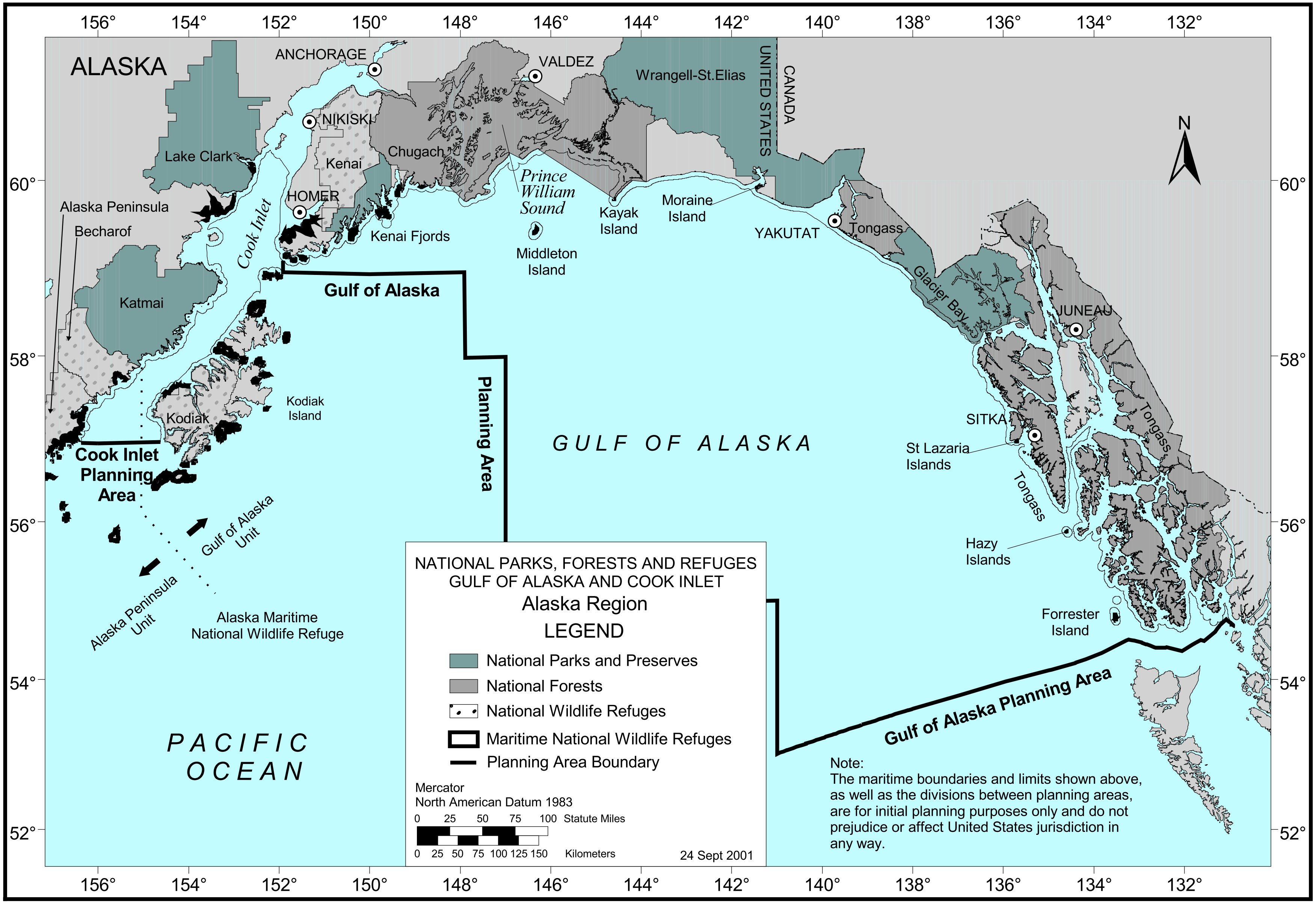

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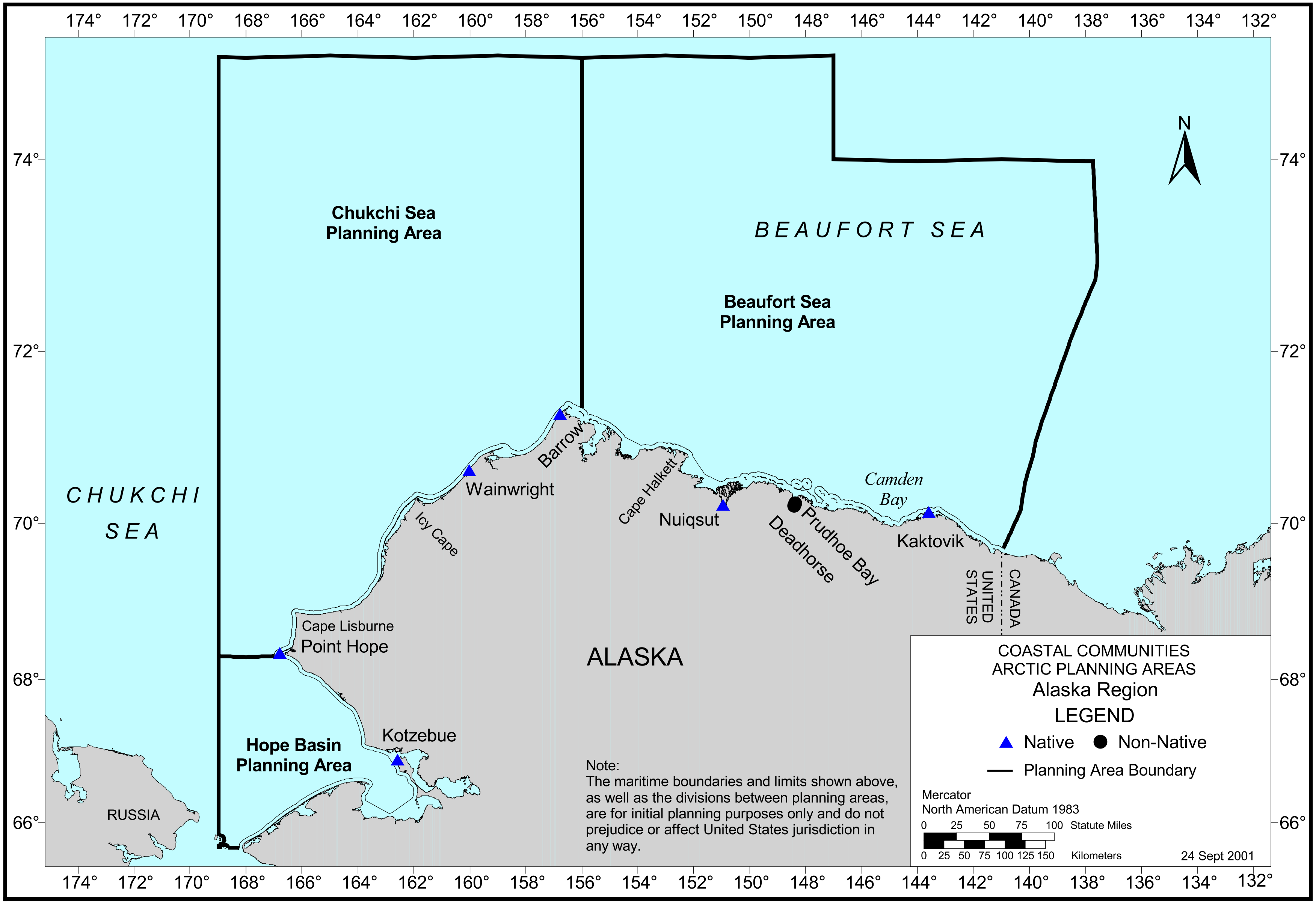

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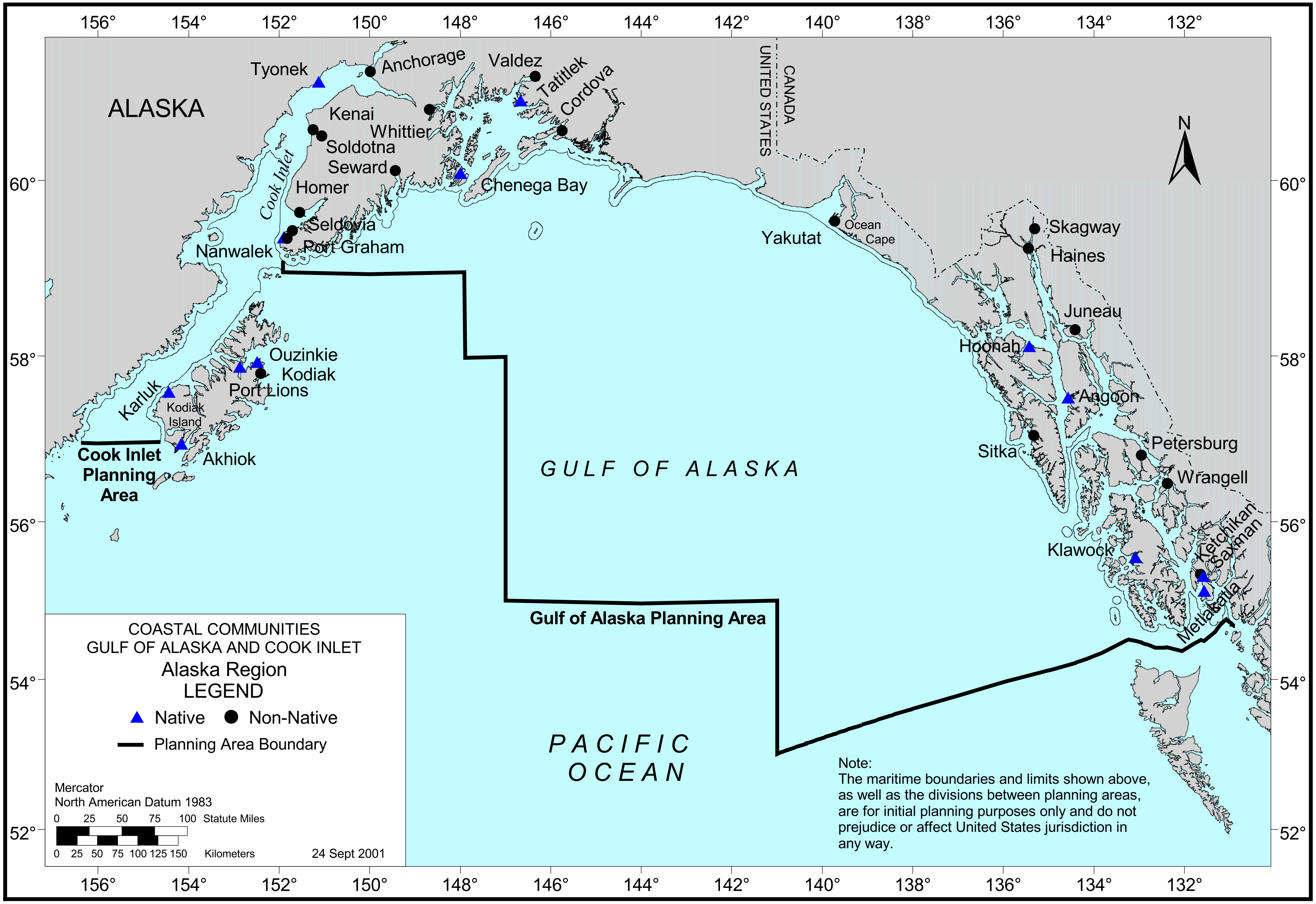

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TABLES

Table 3-1. Marine Mammals of the Gulf of Mexico

Species	Status[a]	Occurrence[b]	Typical Habitat		
			Coastal	Shelf	Slope/ Deep
ORDER CETACEA					
Suborder Mysticeti (baleen whales)					
Family Balaenidae					
Eubalaena glacialis (northern right whale)	E	1	--	X	X
Family Balaenopteridae					
Balaenoptera musculus (blue whale)	E	1	--	X	X
Balaenoptera edeni (Bryde's whale)	--	3	--	X	X
Balaenoptera physalus (Fin whale)	E	2	--	X	X
Megaptera novaeangliae (humpback whale)	E	2	--	X	X
Balaenoptera acutorostrata (minke whale)	--	2	--	X	X
Balaenoptera borealis (sei whale)	E	2	--	X	X
Suborder Odontoceti (toothed whales and dolphins)					
Family Physeteridae					
Kogia simus (dwarf sperm whale)	--	3	--	--	X
Kogia breviceps (pygmy sperm whale)	--	3	--	--	X
Physeter macrocephalus (sperm whale)	E	4	--	--	X
Family Ziphiidae					
Mesoplodon densirostris (Blainville's beaked whale)	--	2[c]	--	--	X
Ziphius cavirostris (Cuvier's beaked whale)	--	2[c]	--	--	X
Mesoplodon europaeus (Gervais' beaked whale)	--	3[c]	--	--	X
Mesoplodon bidens (Sowerby's beaked whale)	--	1[c]	--	--	X
Family Delphinidae					
Stenella frontalis (Atlantic spotted dolphin)	--	4	--	X	X
Tursiops truncatus (bottlenose dolphin)	--	4	X	X	X
Stenella clymene (clymene dolphin)	--	4	--	--	X
Pseudorca crassidens (false killer whale)	--	3	--	--	X
Lagenodelphis hosei (Fraser's dolphin)	--	4	--	--	X
Orcinus orca (killer whale)	--	3	--	--	X
Peponocephala electra (melon-headed whale)	--	4	--	--	X
Stenella attenuata (pantropical spotted dolphin)	--	4	--	--	X
Feresa attenuata (pygmy killer whale)	--	3	--	--	X
Globicephala macrorhynchus (short-finned pilot whale)	--	4	--	--	X
Grampus griseus (Risso's dolphin)	--	4	--	--	X
Steno bredanensis (rough-toothed dolphin)	--	4	--	--	X
Stenella longirostris (spinner dolphin)	--	4	--	--	X
Stenella coeruleoalba (striped dolphin)	--	4	--	--	X
ORDER SIRENIA (dugongs and manatees)					
Family Trichechidae					
Trichechus manatus (West Indian manatee)	E	2	X	--	--

[a] Status: E = endangered under the Endangered Species Act of 1973.

[b] occurrence: 1 = extralimital; 2 = rare; 3 = uncommon; 4 = common (adapted from Würsig et al., 2000).

[c] beaked whales in the Gulf of Mexico may be uncommon or common rather than rare or extralimital. Their population status is uncertain because they are difficult to see and identify to species. Most surveys have been conducted in sea states that are not optimal for sighting beaked whales.

Table 3-2. Marine and Coastal Birds of the Gulf of Mexico

Category	Order	Family Name	Common Name
Seabirds			
	Charadriiformes	Laridae	gulls and terns
		Scolopacidae	phalaropes
	Gaviiformes	Gaviidae	loons
	Pelicaniformes	Fregatidae	frigatebirds
		Pelicanidae	pelicans
		Phaethontidae	tropicbirds
		Phalacrocoracidae	cormorants
		Sulidae	gannets and boobies
	Procellariiformes	Diomedeidae	albatrosses
		Hydrobatidae	storm-petrels
		Procellariidae	petrels and shearwaters
Shorebirds			
	Charadriiformes	Charadriidae	plovers
		Haematopodidae	oystercatchers
		Recurvirostridae	stilts and avocets
		Scolopacidae	sandpipers, snipes, and allies
Wetland Birds			
	Charadriiformes	Jacanidae	jacanas
	Ciconiiformes	Aramidae	limkins
		Ardeidae	bitterns, egrets, and herons
		Ciconiidae	storks
		Threskiornithidae	ibises and spoonbills
	Gruiformes	Gruidae	cranes
		Rallidae	rails and coots, moorhens, and gallinules
	Pelicaniformes	Anhingidae	darters and anhingas
	Podicipediformes	Podicipedidae	grebes
Waterfowl			
	Anseriformes	Anatidae	ducks, geese, and swans

Table 3-3. Common Taxa Representing Major Shelf and Oceanic Fish Assemblages in the Gulf of Mexico

Category	Assemblage	Common Name	Scientific Name
Shelf Fishes			
	soft bottom		
	pink shrimp	dusky flounder	*Syacium papillosum*
		sand perch	*Diplectrum formosum*
		silver jenny	*Eucinostomus gula*
		pigfish	*Orthopristis chrysoptera*
		Atlantic bumper	*Chloroscombrus chrysurus*
	brown shrimp	longspine porgy	*Stenotomus caprinus*
		horned sea robin	*Bellator militaris*
		leopard sea robin	*Prionotus scitulus*
		dwarf goatfish	*Upeneus parvus*
	white shrimp	Atlantic croaker	*Micropogonias undulatus*
		star drum	*Stellifer lanceolatus*
		Atlantic cutlassfish	*Trichiurus lepturus*
		sand sea trout	*Cynoscion arenarius*
		silver sea trout	*Cynoscion nothus*
		hardhead catfish	*Arius felis*
	hard bottom		
	(< 50 m depths)	tomtate	*Haemulon aurolineatum*
		red snapper	*Lutjanus campechanus*
		gag	*Mycteroperca microlepis*
		bank sea bass	*Centropristis ocyurus*
		blue angelfish	*Holacanthus bermudensis*
		gray triggerfish	*Balistes capriscus*
	(> 50 m depths)	roughtongue bass	*Pronotogrammus martinicensis*
		bank butterflyfish	*Chaetodon aya*
		scamp	*Mycteroperca phenax*
		tattler	*Serranus phoebe*
		short bigeye	*Pristgenys alta*
	coastal pelagic	Spanish mackerel	*Scomberomorus maculatus*
		king mackerel	*Scomberomorus cavalla*
		cobia	*Rachycentron canadum*
		crevalle jack	*Caranx hippos*
		bluefish	*Pomatomus saltatrix*
Oceanic Fishes			
	epipelagic	blue marlin	*Makaira nigricans*
		yellowfin tuna	*Thunnus albacares*
		dolphin	*Coryphaena hippurus*
		wahoo	*Acanthocybium solanderi*
		swordfish	*Xiphias gladius*
	midwater	bristlemouths	Gonostomatidae
		lanternfishes	Myctophidae
		hatchetfishes	Sternoptychidae
	demersal	grenadiers	Macrouridae
		cusk-eels	Ophidiidae
		hakes	Gadidae
		eels	Synaphobranchidae

Table 3-4. Sea Turtles of the Gulf of Mexico

Species	Status	Typical Adult Habitat	Juvenile/Hatchlings Potentially Present?	Nesting
Family Cheloniidae				
Caretta caretta (loggerhead turtle)	T	estuarine, coastal, and shelf waters	Yes	some nesting along northern gulf coast; main u.s. nesting beaches are in southeast Florida
Chelonia mydas (green turtle)	T,E[a]	shallow coastal waters, seagrass beds	Yes	isolated and infrequent nesting in northern Gulf
Eretmochelys imbricata (hawksbill turtle)	E	coral reefs, hard bottom areas in coastal waters; adults not often sighted in northern Gulf	Yes	nesting in continental U.S. is limited to southeastern Florida and Florida keys
Lepidochelys kempi (Kemp's ridley turtle)	E	shallow coastal waters, seagrass beds	Yes	nests mainly at Rancho Nuevo, Mexico; minor nesting on Padre and Mustang Islands, Texas
Family Dermochelyidae				
Dermochelys coriacea (leatherback turtle)	E	slope, shelf, and coastal waters; considered the most "pelagic" of the sea turtles	Yes	some nesting in northern Gulf, especially Florida Panhandle; nearest major nesting concentrations are in Caribbean and southeast Florida

Status: E = endangered species and T = threatened species under the Endangered Species Act of 1973.

[a] Green sea turtles are listed as threatened except for Florida where breeding populations are listed as endangered.

Table 3-5. Topographic Features of the Central and Western Gulf of Mexico

SHELF EDGE BANKS	MIDSHELF BANKS	SOUTH TEXAS BANKS
Bright Bank	Sonnier Bank	Mysterious Bank
McGrail Bank	29 Fathom Bank	Baker Bank
Rankin Bank	Fishnet Bank	Aransas Bank
Alderdice Bank	Claypile Lump	Southern Bank
Rezak Bank	32 Fathom Bank	North Hospital Bank
Sidner Bank	Coffee Lump	Hospital Bank
Ewing Bank	Stetson Bank	South Baker Bank
Jakkula Bank		Dream Bank
Bouma Bank		Blackfish Ridge
Parker Bank		Big Dunn Bar
Sackett Bank		Small Dunn Bar
Diaphus Bank		
Sweet Bank		
East Flower Garden Bank		
West Flower Garden Bank		
Geyer Bank		
Elvers Bank		
MacNeil Bank		
Applebaum Bank		

Source: USDOI, MMS (1996a).

Table 3-6. Benthic Zones Characteristic of Western and Central Gulf of Mexico Topographic Features

Benthic Zone	Depth Range	Description
Diploria-Montastrea-Porites	< 20 – 36 m	diverse community of hermatypic corals and coralline algae
Madracis and leafy algae	28 – 46 m	branching coral *Madracis mirabilis* and various species of leafy algae
Stephanocoenia-Millepora	36 – 52 m	less diverse community of hermatypic corals and coralline algae
algal-sponge	55 – 85 m	coralline algae producing algal nodules with abundant leafy algae and sponges
Millepora-sponge	< 20 – 36 m	hydrocoral *Millepora* sp. and various sponges abundant
antipatharian	85 – 90 m	antipatharians and crinoids most abundant fauna
nepheloid	> 90 m	highly turbid zone with occasional deepwater octocorals and solitary stony corals

Source: Rezak et al. (1983).

Table 3-7. Deep-Sea Faunal Zones in the Gulf of Mexico

Faunal Assemblage	Depth Range
Shelf/Slope Transition Zone	300 – 500 m
Upper Archibenthal Zone	500 – 800 m
Lower Archibenthal Zone	800 – 1,650 m
Upper Abyssal Zone	1,650 – 2,250 m
Mesoabyssal Zone	2,250 – 3,000 m

Source: Gallaway and Kennicutt (1988).

Table 3-8. Managed Species of Invertebrates and Reeffishes for Which Essential Fish Habitat Has Been Designated in the Gulf of Mexico

Species	Life Stages (Reproductive Activity)	Habitat
Invertebrates		
brown shrimp (*Penaeus aztecus*)	adults; larvae	soft bottom; pelagic
white shrimp (*Penaeus setiferus*)	adults; larvae	soft bottom; pelagic
pink shrimp (*Penaeus duorarum*)	adults; larvae	soft bottom; pelagic
stone crab (*Menippe* spp.)	adults; larvae	soft bottom; pelagic
spiny lobster (*Panulirus argus*)	adults; larvae	hard bottom; pelagic
yal red shrimp (*Hymenopenaeus robustus*)	adults; larvae	soft bottom; pelagic
Reeffish		
red grouper (*Epinephelus morio*)	adults and juveniles; eggs and larvae	hard bottom; pelagic
gag (*Mycteroperca microlepis*)	adults and juveniles; eggs and larvae	hard bottom; pelagic
scamp (*Mycteroperca phenax*)	adults and juveniles; eggs and larvae	hard bottom; pelagic
red snapper (*Lutjanus campechanus*)	adults; juveniles; eggs and larvae	hard bottom; soft bottom; pelagic
lane snapper (*Lutjanus synagris*)	adults and juveniles; eggs and larvae	hard bottom; pelagic
yellowtail snapper (*Ocyurus chrysurus*)	adults and juveniles; eggs and larvae	hard bottom; pelagic
tilefish (*Lopholatilus chamaeleonticeps*)	adults and juveniles; eggs and larvae	soft bottom; pelagic
greater amberjack (*Seriola dumerili*)	adults and juveniles; eggs and larvae	hard bottom; pelagic
lesser amberjack (*Seriola fasciata*)	adults and juveniles; eggs and larvae	hard bottom; pelagic
gray triggerfish (*Balistes capriscus*)	adults; eggs; larvae and juveniles	hard bottom; pelagic
black grouper (*Mycteroperca bonaci*)	adults; eggs; larvae and juveniles	hard bottom; pelagic
vermilion snapper (*Rhomboplites aurorubens*)	adults; eggs; larvae and juveniles	hard bottom; pelagic
gray snapper (*Lutjanus griseus*)	adults; eggs; larvae and juveniles	hard bottom; pelagic

Source: Gulf of Mexico Fishery Management Council (1998).

Table 3-9. Managed Species of Coastal Pelagic Fishes and Red Drum for Which Essential Fish Habitat Has Been Designated in the Gulf of Mexico

Species	Life Stages (Reproductive Activity)	Habitat
Coastal Pelagic Fishes		
cobia (*Rachycentron canadum*)	adults; juveniles/subadults; larvae and eggs	pelagic
king mackerel (*Scomberomorus cavalla*)	adults; juveniles/subadults; larvae and eggs (spawning area)	pelagic
spanish mackerel (*Scomberomorus maculatus*)	adults; juveniles/subadults; larvae and eggs (spawning area)	pelagic
dolphin (*Coryphaena hippurus*)	adults; juveniles/subadults; larvae and eggs (spawning area)	pelagic
bluefish (*Pomatomus saltatrix*)	adults; juveniles/subadults; larvae and eggs (spawning area))	pelagic
little tunny (*Euthynnus alletteratus*)	adults; juveniles/subadults; larvae and eggs (spawning area)	pelagic
Red Drum		
red drum (*Sciaenops ocellatus*)	adults; larvae and eggs (spawning area)	soft bottom; pelagic

Source: Gulf of Mexico Fishery Management Council (1998).

Table 3-10. Managed Highly Migratory Species for Which Essential Fish Habitat Has Been Designated in the Gulf of Mexico

Species	Life Stages (Reproductive Activity)	Habitat
Swordfish		
swordfish (*Xiphias gladius*)	adults; larvae and eggs (spawning area)	pelagic
Tuna		
skipjack tuna (*Katsuwonus pelamis*)	adults; larvae and eggs (spawning area)	pelagic
yellowfin tuna (*Thunnus albacares*)	adults; juveniles/subadults; larvae and eggs (spawning area)	pelagic
bluefin tuna (*Thunnus thynnus*)	adults; larvae and eggs (spawning area)	pelagic
Sharks		
nurse shark (*Ginglymostoma cirratum*)	adults; late juvenile/subadult; neonates/early juveniles	pelagic
longfin mako shark (*Isurus paucus*)	adults; late juvenile/subadult; neonates/early juveniles	pelagic
blacknose shark (*Carcharhinus acronotus*)	adults; late juvenile/subadult; neonates/early juveniles	pelagic
spinner shark (*Carcharhinus brevipinna*)	late juvenile/subadult	pelagic
silky shark (*Carcharhinus falciformis*)	adults; late juvenile/subadult; neonates/early juveniles	pelagic
bull shark (*Carcharhinus leucas*)	adults; late juvenile/subadult; neonates/early juveniles	pelagic
blacktip shark (*Carcharhinus limbatus*)	late juveniles/subadults	pelagic
dusky shark (*Carcharhinus obscurus*)	neonates/early juveniles	pelagic
Caribbean reef shark (*Carcharhinus perezi*)	adult; late juveniles/subadults	pelagic
sandbar shark (*Carcharhinus plumbeus*)	adults; late juvenile/subadult; neonates/early juveniles	pelagic
tiger shark (*Galeocerdo cuvieri*)	adults; late juvenile/subadult; neonates/early juveniles	pelagic
lemon shark (*Negaprion brevirostris*)	adults; late juvenile/subadult; neonates/early juveniles	pelagic
scalloped hammerhead (*Sphyrna lewini*)	adults; late juvenile/subadults	pelagic
great hammerhead (*Sphyrna mokarran*)	adults; late juvenile/subadults	pelagic
bonnethead (*Sphyrna tiburo*)	adults; late juvenile/subadult; neonates/early juveniles	pelagic
Atlantic sharpnose shark (*Rhizoprionodon terraenovae*)	adults; late juvenile/subadult; neonates/early juveniles	pelagic

Source: USDOC, NMFS (1999).

Table 3-11. National Wildlife Refuges Along The Gulf Of Mexico Coast From Texas Through Florida

National Wildlife Refuge Name	Total Area (ha)	Includes Wetlands
Texas		
Laguna Atascosa	23,402	+
Aransas	46,296	+
San Bernard	12,249	+
Brazoria	17,767	+
Anahuac	13,880	+
Texas Point	3,623	+
Louisiana		
Shell Keys	3	--
Bayou Sauvage	9,009	+
Delta	19,749	+
Breton	3,661	+
Mississippi		
Grand Bay	2,072	+
Alabama		
Grand Bay	1,010	+
Bon Secour	2,703	+
Florida		
St. Vincent	5,055	+
St. Marks	27,164	+
Cedar Keys	361	+
Chassahowitzka	12,482	+
Pinellas	160	+
Egmont Key	133	--
Passage Key	26	--
Matlacha Pass	159	+
Island Bay	8	+
Pine Island	244	+
J.N. Ding Darling	2,556	+
Ten Thousand Islands	14,178	+
Caloosahatchee	16	+
Key West	84,302	+
Great White Heron	77,939	+
National Key Deer	3,486	+
Crocodile Lake	2,707	+

Sources: National Audubon Society (2001); U.S. Department Of The Interior, Fish And Wildlife Service (2001).

Table 3-12. Gulf of Mexico Coastal Population Overview

MMS Planning Area	Labor Market Area	1970	1980	1990	1999
Western	Brownsville	355,180	537,717	701,888	949,129
	Corpus Christi	389,905	441,121	465,297	514,835
	Victoria	125,896	144,833	149,963	163,510
	Brazoria	172,954	247,657	268,590	313,573
	Houston-Galveston	2,112,332	3,001,402	3,601,782	4,339,900
	Beaumont-Port Arthur	409,262	460,162	453,230	497,367
	Total:	**3,565,529**	**4,832,892**	**5,640,750**	**6,778,314**
Central	Lake Charles	280,639	313,284	321,386	329,148
	Lafayette	407,042	476,339	496,579	540,190
	Baton Rouge	533,221	672,081	709,562	777,010
	Houma	225,396	263,213	263,681	276,881
	New Orleans	1,186,117	1,348,007	1,328,455	1,353,677
	Biloxi-Gulfport	296,851	368,852	388,725	447,024
	Mobile	435,958	502,814	534,425	597,685
	Total:	**3,365,224**	**3,944,590**	**4,042,813**	**4,321,615**
Eastern	Pensacola	347,349	421,002	515,942	615,915
	Panama City	92,444	116,059	147,465	171,820
	Tallahassee	224,927	293,750	349,748	399,952
	Lake City	78,610	101,908	119,581	143,621
	Gainesville	149,288	214,925	260,538	297,317
	Ocala	88,226	177,191	288,348	363,742
	Tampa-St. Petersburg	1,105,553	1,613,603	2,067,959	2,287,586
	Sarasota	258,147	428,192	624,323	713,001
	Naples	143,256	291,237	487,212	605,187
	Miami	1,940,447	2,707,169	3,270,606	3,795,019
	Total:	**4,428,247**	**6,365,036**	**8,131,722**	**9,393,160**
Western/Eastern (Combined)	**Total:**	**11,359,000**	**15,142,518**	**17,815,285**	**20,493,089**

Table 3-13. Gulf of Mexico Coastal Region Population and Employment Composition

Population Variable	1970	1980	1990	1999
total population	11,359,000	15,142,518	17,815,285	20,432,908
percent change from previous period	--	33.31	17.65	14.69
Population Variable	**1970**	**1980**	**1990**	**% change (1970-1990)**
Age Structure (%)				
0 - 5	8.5	7.4	8.9	3.89
6 - 15	20.7	15.8	14.3	-30.57
16 - 17	5.7	5.1	2.8	-51.95
18 - 24	11.2	12.8	9.8	-12.46
25 - 34	12.0	16.3	17.1	42.67
35 - 44	11.2	11.0	14.6	30.11
45 - 54	10.7	9.7	10.1	-6.23
55 – 64	9.2	9.5	8.7	-5.86
65+	10.7	12.5	13.8	28.44
Race and Ethnic Composition (%)				
Black	18.4	17.2	17.1	-6.97
Hispanic	9.7	13.4	17.2	77.55
White	71.6	68.2	63.7	-10.99
Other	0.3	1.2	1.9	510.42
Education of Persons Age 25+ (%)				
0 - 8 years schooling	31.9	20.5	13.3	-58.20
9 - 11 years schooling	20.1	15.8	16.8	-16.06
high school graduates	27.2	32.1	30.3	11.24
13 -15 years schooling	10.6	16.0	20.0	89.07
college graduates	10.2	15.7	19.5	90.50
Labor Force Size				
civilian	3,983,979	6,363,346	7,747,442	94.46
military	119,341	81,664	95,819	-19.71
total	4,103,320	6,445,010	7,843,261	91.14
Employment by Industrial Sector (%)				
agriculture, forestry, mining	5.7	5.8	4.0	-29.75
construction	8.9	10.6	7.6	-14.74
business services	3.6	5.3	5.4	49.43
communications, utilities	3.5	3.6	2.9	-18.18
nondurable manufacturing	8.9	8.3	5.9	-33.63
durable manufacturing	7.8	8.9	6.1	-21.43
finance, insurance, real estate	5.3	7.3	6.9	32.17
services	29.0	19.0	33.2	14.69
wholesale, retail trade	22.8	25.4	23.1	1.26
transportation	4.5	5.8	4.8	6.13
Employment by Occupation Group (%)				
management, professional	10.5	12.8	14.5	37.75
technical	1.6	3.8	4.6	181.52
sales	9.3	13.5	16.1	73.28
clerical	19.9	20.1	19.3	-2.94
precision craft	17.6	17.7	14.6	-16.85
operative, transportation	11.7	7.4	5.6	-51.91
service, except household	16.8	15.3	17.0	1.31
farming, fishing, forestry	2.9	2.7	2.7	-6.93
household service	3.0	1.0	0.8	-73.91
laborers	6.6	5.8	4.8	-28.16

Note: Data for 1999, other than total population, were not available at the time of this report.

Table 3-14. Western Gulf of Mexico Planning Area Population and Employment Summary

Population Variable	1970	1980	1990	1999
total population	3,565,529	4,832,892	5,640,750	6,756,551
percent change from previous period	--	35.54	16.72	19.78

Population Variable	1970	1980	1990	% change (1970-1990)
Age Structure (%)				
0 - 5	9.4	8.6	10.1	7.43
6 - 15	22.3	17.5	16.6	-25.46
16 - 17	6.2	5.5	3.1	-49.52
18 - 24	11.2	13.3	10.1	-9.98
25 - 34	13.1	18.4	18.4	40.70
35 - 44	12.0	11.7	15.6	30.27
45 - 54	10.6	9.6	9.9	-7.00
55 - 64	8.0	7.7	7.3	-8.20
65+	7.2	7.8	8.8	22.54
Race and Ethnic Composition (%)				
Black	15.4	14.6	14.3	-7.17
Hispanic	18.8	24.3	30.0	59.15
White	65.4	59.4	52.9	-19.11
Other	0.4	1.6	2.8	670.63
Education of Persons Age 25+ (%)				
0 - 8 years schooling	31.5	21.2	16.0	-49.13
9 - 11 years schooling	21.8	15.7	15.2	-30.37
high school graduates	23.9	28.3	26.3	9.81
13 –15 years schooling	11.3	16.9	21.1	86.46
college graduates	11.4	18.0	21.4	87.22
Labor Force Size				
civilian	1,324,657	2,211,824	2,511,351	89.59
military	11,964	6,753	7,202	-39.80
total	1,336,621	2,218,577	2,518,553	88.43
Employment by Industrial Sector (%)				
agriculture, forestry, mining	6.7	7.3	5.2	-22.17
construction	9.1	11.6	8.1	-10.46
business services	3.8	5.5	5.6	47.15
communications, utilities	3.2	3.4	2.9	-9.56
nondurable manufacturing	10.2	9.5	7.2	-29.58
durable manufacturing	8.9	10.5	6.4	-28.40
finance, insurance, real estate	4.8	6.5	6.2	28.16
services	26.8	16.7	31.7	18.21
wholesale, retail trade	22.2	23.7	22.1	-0.82
transportation	4.2	5.4	4.6	10.26
Employment by Occupation Group (%)				
management, professional	10.1	12.6	14.9	47.53
technical	1.9	4.3	5.0	158.05
sales	9.1	12.9	15.3	67.52
clerical	20.0	20.4	18.9	-5.15
precision craft	18.3	19.4	15.3	-16.18
operative, transportation	12.5	7.9	5.9	-53.06
service, except household	15.4	13.2	16.1	4.36
farming, fishing, forestry	3.3	2.5	2.6	-21.64
household service	2.8	0.9	0.9	-66.89
laborers	6.6	6.0	5.1	-22.80

Table 3-15. Central Gulf of Mexico Planning Area Population and Employment Summary

Population Variable	1970	1980	1990	1999
total population	3,365,224	3,944,590	4,042,813	4,309,016
percent change from previous period	--	17.22	2.49	6.58

Population Variable	1970	1980	1990	% change (1970-1990)
Age Structure (%)				
0 - 5	9.6	8.6	9.6	-0.41
6 - 15	22.7	17.6	16.3	-28.00
16 - 17	6.3	5.7	3.1	-51.15
18 - 24	12.3	14.2	10.7	-13.15
25 - 34	12.2	16.6	17.1	40.01
35 - 44	11.0	10.9	14.6	33.19
45 - 54	10.2	9.3	9.9	-3.03
55 - 64	8.0	8.2	8.1	0.15
65+	7.7	8.9	10.7	38.71
Race and Ethnic Composition (%)				
Black	27.4	27.4	28.6	4.20
Hispanic	2.1	2.4	2.2	2.57
White	70.2	69.1	67.6	-3.67
Other	0.3	1.1	1.6	493.74
Education of Persons Age 25+ (%)				
0 - 8 years schooling	37.4	23.7	14.5	-61.28
9 - 11 years schooling	19.4	16.8	17.6	-9.22
high school graduates	25.9	32.0	32.8	26.88
13 –15 years schooling	8.5	13.5	18.2	114.71
college graduates	8.9	13.9	16.9	90.18
Labor Force Size				
civilian	1,079,779	1,547,311	1,604,620	48.61
military	48,005	30,597	36,067	-24.87
total	1,127,784	1,577,908	1,640,687	45.48
Employment by Industrial Sector (%)				
agriculture, forestry, mining	7.2	7.6	5.0	-30.78
construction	8.9	11.2	7.2	-19.43
business services	3.1	4.6	4.5	46.74
communications, utilities	3.5	3.7	2.9	-18.26
nondurable manufacturing	10.0	9.8	7.6	-24.31
durable manufacturing	7.6	8.3	6.2	-18.77
finance, insurance, real estate	4.5	5.9	5.7	25.57
services	28.5	17.7	33.7	18.33
wholesale, retail trade	21.5	24.6	22.3	3.69
transportation	5.1	6.6	5.0	-3.52
Employment by Occupation Group (%)				
management, professional	10.4	11.4	12.9	23.82
technical	1.5	3.8	4.7	202.33
sales	7.9	12.4	15.3	93.16
clerical	18.3	19.1	19.0	3.65
precision craft	17.9	19.5	16.1	-10.18
operative, transportation	12.9	8.1	6.7	-48.01
service, except household	17.0	15.5	16.9	-0.38
farming, fishing, forestry	2.9	2.4	2.6	-12.25
household service	3.7	1.1	0.8	-78.16
laborers	7.3	6.6	5.1	-30.73

Table 3-16. Eastern Gulf of Mexico Planning Area Population and Employment Summary

Population Variable	1970	1980	1990	1999
total population	4,428,247	6,365,036	8,131,722	9,367,341
percent change from previous period	--	43.74	27.76	15.20

Population Variable	1970	1980	1990	% change (1970-1990)
Age Structure (%)				
0 - 5	7.0	5.6	7.7	9.22
6 - 15	17.8	13.5	11.8	-33.82
16 - 17	4.9	4.4	2.3	-52.71
18 - 24	10.3	11.5	9.2	-11.47
25 - 34	11.0	14.4	16.3	48.00
35 - 44	10.8	10.6	13.9	28.62
45 - 54	11.2	10.1	10.2	-8.41
55 - 64	11.0	11.7	9.9	-10.58
65+	15.9	18.3	18.8	18.18
Race and Ethnic Composition (%)				
Black	13.9	12.9	13.4	-4.10
Hispanic	8.1	11.8	15.9	95.56
White	77.6	74.3	69.3	-10.75
Other	0.3	1.0	1.5	374.23
Education of Persons Age 25+ (%)				
0 - 8 years schooling	28.7	18.3	11.1	-61.14
9 - 11 years schooling	19.3	15.4	17.5	-9.17
high school graduates	30.4	34.6	31.7	4.24
13 –15 years schooling	11.4	16.6	20.2	76.79
college graduates	10.2	15.1	19.5	90.05
Labor Force Size				
civilian	1,579,543	2,604,211	3,631,471	129.91
military	59,372	44,314	52,550	-11.49
total	1,638,915	2,648,525	3,684,021	124.78
Employment by Industrial Sector (%)				
agriculture, forestry, mining	3.9	3.4	2.8	-28.97
construction	8.8	9.4	7.5	-15.63
business services	3.8	5.5	5.7	48.02
communications, utilities	3.8	3.8	2.8	-24.31
nondurable manufacturing	6.9	6.4	4.2	-39.14
durable manufacturing	6.9	7.8	5.9	-14.79
finance, insurance, real estate	6.1	8.8	8.0	31.26
services	31.1	21.8	34.0	9.54
wholesale, retail trade	24.3	27.4	24.3	-0.08
transportation	4.4	5.7	4.9	10.76
Employment by Occupation Group (%)				
management, professional	11.0	13.7	14.9	36.07
technical	1.4	3.5	4.3	197.52
sales	10.3	14.5	17.0	64.06
clerical	20.9	20.5	19.7	-5.74
precision craft	16.8	15.3	13.5	-19.48
operative, transportation	10.3	6.5	5.0	-51.15
service, except household	17.8	17.1	17.7	-0.61
farming, fishing, forestry	2.6	3.0	2.9	10.03
household service	2.8	1.0	0.7	-74.92
laborers	6.1	5.1	4.4	-28.63

Table 3-17(a). Gulf of Mexico Coastal Commuting Zones Population Projections

Year	Age Group								Total Population*	5-Year Growth Rate
	0-19		20-34		35-64		65+			
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total		
1980	4,816,860	31.7%	3,862,580	25.5%	4,592,630	30.3%	1,904,190	12.6%	15,176,260	--
1985	4,982,390	29.6%	4,367,210	26.0%	5,298,300	31.5%	2,163,390	12.9%	16,811,290	10.8%
1990	5,226,510	29.2%	4,286,390	24.0%	5,905,400	33.0%	2,464,370	13.8%	17,882,670	6.4%
1995	5,629,340	29.1%	4,162,360	21.5%	6,857,030	35.4%	2,706,100	14.0%	19,354,830	8.2%
2000	5,957,170	28.8%	4,004,280	19.4%	7,840,400	37.9%	2,880,080	13.9%	20,681,930	6.9%
2005	6,134,000	27.9%	4,175,000	19.0%	8,587,000	39.1%	3,058,000	13.9%	21,964,000	6.2%
2010	6,310,000	27.1%	4,464,000	19.2%	9,091,000	39.1%	3,410,000	14.7%	23,275,000	6.0%
2015	6,491,000	26.4%	4,786,000	19.4%	9,338,000	37.9%	4,005,000	16.3%	24,620,000	5.8%
2020	6,789,000	26.2%	4,904,000	18.9%	9,501,000	36.6%	4,465,000	17.2%	25,938,000	5.4%

*Mid-year estimates (July 1) for each year.

Table 3-17(b). Western Gulf of Mexico Planning Area Coastal Commuting Zones Population Projections

Year	Age Group								Total Population*	5-Year Growth Rate
	0-19		20-34		35-64		65+			
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total		
1980	1,700,930	35.2%	1,356,570	28.0%	1,400,620	28.9%	380,080	7.9%	4,838,200	--
1985	1,817,730	33.5%	1,518,260	27.9%	1,662,290	30.6%	434,170	8.0%	5,432,450	12.3%
1990	1,882,880	33.2%	1,439,110	25.4%	1,845,640	32.6%	501,290	8.8%	5,668,920	4.4%
1995	2,066,220	32.7%	1,437,920	22.8%	2,245,860	35.6%	562,530	8.9%	6,312,530	11.4%
2000	2,256,480	32.8%	1,429,040	20.8%	2,556,620	37.2%	630,400	9.2%	6,872,540	8.9%
2005	2,390,000	32.3%	1,534,000	20.7%	2,788,000	37.6%	686,000	9.3%	7,409,000	7.8%
2010	2,534,000	31.8%	1,671,000	21.0%	2,960,000	37.2%	796,000	10.0%	7,962,000	7.5%
2015	2,676,000	31.3%	1,830,000	21.4%	3,076,000	36.0%	960,000	11.2%	8,542,000	7.3%
2020	2,873,000	31.4%	1,917,000	21.0%	3,188,000	34.9%	983,000	10.8%	9,141,000	7.0%

*Mid-year estimates (July 1) for each year.

Table 3-17(c). Central Gulf of Mexico Planning Area Coastal Commuting Zones Population Projections

Year	Age Group								Total Population*	5-Year Growth Rate
	0-19		20-34		35-64		65+			
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total		
1980	1,414,230	35.9%	1,053,630	26.7%	1,122,410	28.5%	351,890	8.9%	3,942,160	--
1985	1,392,230	33.6%	1,111,630	26.9%	1,246,610	30.1%	389,550	9.4%	4,140,020	5.0%
1990	1,287,790	31.8%	1,000,060	24.7%	1,323,610	32.7%	432,340	10.7%	4,043,800	-2.3%
1995	1,323,950	31.4%	944,230	22.4%	1,491,340	35.3%	462,170	10.9%	4,221,690	4.4%
2000	1,348,350	30.6%	921,450	20.9%	1,645,780	37.3%	497,390	11.3%	4,412,970	4.5%
2005	1,352,000	29.6%	939,000	20.5%	1,748,000	38.3%	531,000	11.6%	4,571,000	3.6%
2010	1,366,000	28.8%	968,000	20.4%	1,816,000	38.3%	587,000	12.4%	4,738,000	3.7%
2015	1,377,000	28.1%	1,007,000	20.5%	1,837,000	37.4%	686,000	14.0%	4,906,000	3.5%
2020	1,407,000	27.8%	1,017,000	20.1%	1,839,000	36.3%	707,000	14.0%	5,068,000	3.3%

*Mid-year estimates (July 1) for each year.

Table 3-17(d). Eastern Gulf of Mexico Planning Area Coastal Commuting Zones Population Projections

Year	Age Group								Total Population*	5-Year Growth Rate
	0-19		20-34		35-64		65+			
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total		
1980	1,701,700	26.6%	1,452,380	22.7%	2,069,600	32.4%	1,172,220	18.3%	6,395,900	--
1985	1,772,430	24.5%	1,737,320	24.0%	2,389,400	33.0%	1,339,670	18.5%	7,238,820	13.2%
1990	2,055,840	25.2%	1,847,220	22.6%	2,736,150	33.5%	1,530,740	18.7%	8,169,950	12.9%
1995	2,239,170	25.4%	1,780,210	20.2%	3,119,830	35.4%	1,681,400	19.1%	8,820,610	8.0%
2000	2,352,340	25.0%	1,653,790	17.6%	3,638,000	38.7%	1,752,290	18.6%	9,396,420	6.5%
2005	2,392,000	24.0%	1,702,000	17.0%	4,050,000	40.6%	1,841,000	18.4%	9,984,000	6.3%
2010	2,410,000	22.8%	1,825,000	17.3%	4,314,000	40.8%	2,026,000	19.2%	10,576,000	5.9%
2015	2,438,000	21.8%	1,949,000	17.4%	4,426,000	39.6%	2,360,000	21.1%	11,173,000	5.7%
2020	2,509,000	21.4%	1,970,000	16.8%	4,475,000	38.2%	2,775,000	23.7%	11,729,000	5.0%

*Mid-year estimates (July 1) for each year.

Table 3-18(a). Gulf of Mexico Coastal Commuting Zones Labor Force Projections

Year	Age Group								Total Population*	5-Year Growth Rate
	16-19		20-34		35-64		65+			
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total		
1980	1,090,910	14.3%	3,062,470	40.2%	3,242,640	42.6%	222,040	2.9%	7,618,060	--
1985	1,021,320	11.8%	3,550,360	41.1%	3,851,770	44.6%	210,900	2.4%	8,634,350	13.3%
1990	1,010,010	10.9%	3,514,000	37.9%	4,490,930	48.4%	261,230	2.8%	9,276,170	7.4%
1995	1,071,650	10.7%	3,398,080	33.9%	5,269,120	52.5%	292,910	2.9%	10,031,760	8.2%
2000	1,213,080	11.2%	3,274,170	30.1%	6,105,980	56.1%	290,150	2.7%	10,883,380	8.5%
2005	1,291,000	11.1%	3,413,000	29.2%	6,662,000	57.1%	314,000	2.7%	11,681,000	7.3%
2010	1,365,000	11.1%	3,650,000	29.6%	6,938,000	56.3%	370,000	3.0%	12,324,000	5.5%
2015	1,323,000	10.4%	3,915,000	30.8%	7,026,000	55.2%	465,000	3.7%	12,729,000	3.3%
2020	1,357,000	10.4%	4,017,000	30.9%	7,082,000	54.4%	556,000	4.3%	13,012,000	2.2%

*Mid-year estimates (July 1) of working age population, for each year.

Table 3-18(b). Western Gulf of Mexico Planning Area Coastal Commuting Zones Labor Force Projections

Year	Age Group								Total Population*	5-Year Growth Rate
	16-19		20-34		35-64		65+			
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total		
1980	357,420	14.3%	1,080,010	43.3%	1,013,690	40.6%	45,330	1.8%	2,496,450	--
1985	346,840	12.1%	1,239,730	43.3%	1,235,560	43.1%	43,640	1.5%	2,865,770	14.8%
1990	354,430	11.7%	1,183,290	39.2%	1,429,200	47.3%	55,860	1.9%	3,022,780	5.5%
1995	387,220	11.5%	1,178,090	34.9%	1,748,630	51.8%	64,580	1.9%	3,378,520	11.8%
2000	449,550	12.1%	1,172,690	31.6%	2,015,520	54.4%	69,820	1.9%	3,707,580	9.7%
2005	483,000	12.1%	1,259,000	31.4%	2,191,000	54.6%	78,000	2.0%	4,012,000	8.2%
2010	530,000	12.4%	1,372,000	32.0%	2,293,000	53.5%	93,000	2.2%	4,288,000	6.9%
2015	527,000	11.7%	1,502,000	33.4%	2,352,000	52.3%	118,000	2.6%	4,499,000	4.9%
2020	556,000	11.8%	1,576,000	33.6%	2,421,000	51.6%	144,000	3.1%	4,696,000	4.4%

*Mid-year estimates (July 1) of working age population, for each year.

Table 3-18(c). Central Gulf of Mexico Planning Area Coastal Commuting Zones Labor Force Projections

Year	Age Group								Total Population*	5-Year Growth Rate
	16-19		20-34		35-64		65+			
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total		
1980	320,390	16.1%	831,880	41.8%	798,650	40.1%	41,530	2.1%	1,992,450	--
1985	284,510	13.4%	896,580	42.1%	911,540	42.8%	38,920	1.8%	2,131,550	7.0%
1990	252,690	11.9%	811,690	38.3%	1,006,920	47.5%	46,820	2.2%	2,118,120	-0.6%
1995	269,060	12.1%	762,280	34.3%	1,139,720	51.3%	51,210	2.3%	2,222,270	4.9%
2000	281,880	12.0%	745,330	31.7%	1,272,520	54.1%	52,780	2.2%	2,352,510	5.9%
2005	283,000	11.6%	760,000	31.1%	1,347,000	55.0%	57,000	2.3%	2,448,000	4.1%
2010	294,000	11.7%	784,000	31.1%	1,377,000	54.6%	65,000	2.6%	2,521,000	3.0%
2015	285,000	11.1%	816,000	31.9%	1,374,000	53.8%	81,000	3.2%	2,556,000	1.4%
2020	287,000	11.2%	825,000	32.0%	1,367,000	53.1%	95,000	3.7%	2,573,000	0.7%

*Mid-year estimates (July 1) of working age population, for each year.

Table 3-18(d). Eastern Gulf of Mexico Planning Area Coastal Commuting Zones Labor Force Projections

Year	Age Group								Total Population*	5-Year Growth Rate
	16-19		20-34		35-64		65+			
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total		
1980	413,100	13.2%	1,150,580	36.8%	1,430,300	45.7%	135,180	4.3%	3,129,160	--
1985	389,970	10.7%	1,414,050	38.9%	1,704,670	46.9%	128,340	3.5%	3,637,030	16.2%
1990	402,890	9.7%	1,519,020	36.7%	2,054,810	49.7%	158,550	3.8%	4,135,270	13.7%
1995	415,370	9.4%	1,457,710	32.9%	2,380,770	53.7%	177,120	4.0%	4,430,970	7.2%
2000	481,650	10.0%	1,356,150	28.1%	2,817,940	58.4%	168,000	3.5%	4,823,290	8.9%
2005	526,000	10.1%	1,394,000	26.7%	3,124,000	59.8%	178,000	3.4%	5,221,000	8.2%
2010	542,000	9.8%	1,494,000	27.1%	3,268,000	59.3%	211,000	3.8%	5,515,000	5.6%
2015	511,000	9.0%	1,597,000	28.2%	3,299,000	58.2%	266,000	4.7%	5,674,000	2.9%
2020	513,000	8.9%	1,617,000	28.2%	3,295,000	57.4%	317,000	5.5%	5,743,000	1.2%

*Mid-year estimates (July 1) of working age population, for each year.

Table 3-19(a). Gulf of Mexico Coastal Commuting Zones Employment Projections

Industry	2000	2005	2010	2015	2020	% Change (2000-2020)
all-industry total	13,515,460	14,431,000	15,259,000	15,927,000	16,502,000	22.1
farm	225,790	223,000	220,000	216,000	200,000	-11.3
non-farm	13,579,900	14,509,000	15,357,000	16,052,000	16,668,000	22.7
private	11,546,800	12,379,000	13,139,000	13,762,000	14,329,000	24.1
agric. services, forestry	222,200	246,000	267,000	283,000	299,000	34.6
mining	149,320	142,000	137,000	132,000	122,000	-18.5
oil and gas	**143,490**	**136,000**	**131,000**	**126,000**	**116,000**	**-19.0**
construction	853,190	903,000	949,000	985,000	1,011,000	18.5
manufacturing	1,066,780	1,072,000	1,080,000	1,086,000	1,068,000	0.1
durables	514,580	512,000	511,000	510,000	496,000	-3.6
nondurables	552,140	560,000	569,000	576,000	572,000	3.6
transportation & utilities	648,470	681,000	709,000	731,000	744,000	14.7
wholesale trade	623,500	659,000	688,000	708,000	719,000	15.3
retail trade	2,470,450	2,620,000	2,767,000	2,879,000	2,966,000	20.1
finance, insurance, real estate	946,490	994,000	1,037,000	1,073,000	1,100,000	16.2
services	4,566,040	5,062,000	5,505,000	5,884,000	6,300,000	38.0
Government	2,033,210	2,131,000	2,218,000	2,290,000	2,339,000	15.0
Federal civilian	207,940	207,000	206,000	206,000	200,000	-3.7
military	212,190	211,000	212,000	213,000	213,000	0.5
State and local	1,612,920	1,712,000	1,800,000	1,871,000	1,925,000	19.4

Western Planning Area	2000	2005	2010	2015	2020	% Change (2000-2020)
oil and gas	86,073	82,000	79,000	77,000	71,000	-17.2

Central Planning Area	2000	2005	2010	2015	2020	% Change (2000-2020)
oil and gas	48,413	45,000	43,000	40,000	37,000	-23.9

Eastern Planning Area	2000	2005	2010	2015	2020	% Change (2000-2020)
oil and gas	9,004	8,800	8,700	8,700	8,200	-8.9

Table 3-19(b). Gulf of Mexico Coastal Commuting Zones Earnings Projections (in 1987 $millions)

Industry	2000	2005	2010	2015	2020	% Change (2000-2020)
all-industry total	21,820	24,000	27,000	28,000	30,000	39.2%
farm	256	270	280	280	270	6.1%
non-farm	22,181	25,000	27,000	29,000	31,000	39.7%
private	18,344	20,000	23,000	24,000	26,000	41.6%
agric. services, forestry	215	250	290	320	350	62.5%
mining	468	460	460	460	440	-5.3%
oil and gas*	**274**	**270**	**260**	**260**	**250**	**-9.5%**
construction	1,796	2,000	2,200	2,300	2,500	38.6%
manufacturing	2,449	2,600	2,700	2,800	2,900	18.1%
durables	1,046	1,100	1,100	1,200	1,200	14.9%
nondurables	1,361	1,400	1,500	1,500	1,600	16.2%
transportation & utilities	812	900	900	1,000	1,000	24.4%
wholesale trade	1,398	1,500	1,600	1,700	1,800	30.0%
retail trade	2,299	2,500	2,700	2,800	2,900	27.4%
finance, insurance, real estate	1,578	1,800	2,000	2,200	2,400	50.4%
services	6,983	8,000	9,000	10,000	11,000	61.0%
Government	3,677	4,000	4,300	4,600	4,900	32.0%
Federal civilian	547	600	600	600	600	10.9%
military	289	300	310	330	330	15.6%
State and local	2,795	3,100	3,400	3,600	3,900	38.0%

Western Planning Area	2000	2005	2010	2015	2020	% Change (2000-2020)
oil and gas*	168	160	160	160	160	-7.1%

Central Planning Area	2000	2005	2010	2015	2020	% Change (2000-2020)
oil and gas*	95	90	90	90	80	-14.6%

Eastern Planning Area	2000	2005	2010	2015	2020	% Change (2000-2020)
oil and gas*	11	11	12	12	11	-0.9%

*Oil and gas earnings are derived from USDOC, Bureau of Economic Analysis projections. The regional proportion that oil and gas extraction constitutes of total projected primary resource extraction (Mining) is used to estimate oil and gas earnings for areas within each state.

Table 3-20. Primary Commercial Fishing Methods, Species Sought, Seasons, and General Areas Fished in the Gulf of Mexico

Fishing Method	Species Sought	Primary Fishing Season	Primary Fishing Area
bottom trawling	brown shrimp, pink shrimp, white shrimp, seabob, royal red shrimp, and groundfishes	year-round, depending on species and seasonal closures	soft bottom, shelf waters offshore all Gulf States
purse seining	menhaden, butterfish, scads, blue runner, and spanish sardines	spring and summer months	menhaden off Louisiana and Mississippi, scads and sardines off Florida Panhandle
gillnetting	coastal sharks, mullet, black drum	spring and summer, depending on species and seasonal closures	
hook-and-lining (bottom fishing and trolling)	snappers, groupers, amberjacks, triggerfishes, sharks, king mackerel, Spanish mackerel, and cobia	year-round; effort varies with species-specific closures	oil platforms, artificial reefs, and natural hard bottom areas throughout the Gulf
surface longlining	sharks, swordfish, tunas, and dolphinfish	year-round with summer peaks	open Gulf seaward of 200 m
bottom longlining	groupers, snappers, tilefishes, and sharks	year-round; effort varies with species-specific closures	outer shelf waters from Florida to Texas on suitable bottom type
trapping	spiny lobster, stone crab, and reeffishes	stone crab (Oct to Mar.); spiny lobster (July to March); fishes (year-round)	Florida shelf waters

Bottom trawling: a large net held open at the entrance by “doors” is dragged along the bottom or up in the water column behind a towing vessel.
Purse seining: a long rectangular net with a weighted bottom edge and buoyant top, floated by the cork line, is run around a school of fish. The line running along the bottom edge of the net is hauled in closing the bottom of the net and trapping the fish.
Gillnetting: nets used range from several hundred to several thousand feet in length. The size of the mesh in a gillnet reduces the amount of bycatch by allowing most smaller fish to swim through the openings.
Longlining: a continuous mainline supported by float lines (mainline may be surface or subsurface) with regularly spaced leaders with an additional section of monofilament line perpendicular to the mainline, each ending with a baited hook.

Table 3-21. Employment in Tourism-Related Industries in 1990, Gulf of Mexico Coastal Region

Labor Market Area	Non-Tourism Employment	Tourism Related Employment	Percent Employment From Tourism
Biloxi, MS	151,649	24,197	14
New Orleans, LA	504,747	113,611	18
Houma, LA	87,287	19,375	18
Baton Rouge, LA	276,377	51,698	16
Lake Charles, LA	113,760	19,812	15
Lafayette, LA	178,456	26,944	13
Tampa, FL	797,114	165,051	17
Sarasota, FL	213,886	46,252	18
Miami, FL	1,346,820	331,191	20
Fort Myers, FL	183,110	39,816	18
Lake City, FL	42,622	6946	14
Ocala, FL	93,859	16,845	15
Gainesville, FL	101,255	19,930	16
Tallahassee, FL	149,061	27,736	16
Panama City, FL	51,453	13,123	20
Pensacola, FL	182,999	34,460	16
Mobile, AL	240,460	32,127	12
Victoria, TX	85,008	9449	10
Brownsville, TX	218,768	39,714	15
Corpus Christi, TX	183,047	32,234	15
Brazoria, TX	112,192	15,725	12
Houston, TX	1,601,032	267,930	14
Beaumont, TX	165,918	26,334	14

Table 3-22. Marine Mammals of the Alaska Region

Species	Status[a]	Typical Occurrence[b] Arctic	Subarctic
ORDER CETACEA			
Suborder Mysticeti (baleen whales)			
Family Balaenidae			
Eubalaena glacialis (northern right whale)	E	--	X
Family Balaenopteridae			
Balaenoptera acutorostrata (minke whale)	--	X	X
Balaenoptera borealis (sei whale)	E	--	X
Balaenoptera musculus (blue whale)	E	--	X
Balaenoptera mysticetus (bowhead whale)	E	X	--
Balaenoptera physalus (fin whale)	E	X	X
Eschrichtius robustus (gray whale)	--	X	X
Megaptera novaeangliae (humpback whale)	E	X	X
Suborder Odontoceti (toothed whales and dolphins)			
Family Physeteridae			
Physeter macrocephalus (sperm whale)	E	--	X
Family Delphinidae			
Delphinapterus leucas (beluga whale)	D	X	X
Orcinus orca (killer whale)	--	X	X
Family Phocoenidae			
Phocoenoides dalli (Dall's porpoise)	--	--	X
Phocoena phocoena (harbor porpoise)	--	X	X
ORDER CARNIVORA			
Suborder Pinnipedia (seals, sea lions, and walrus)			
Family Otariidae			
Callorhinus ursinus (northern fur seal)	S	--	X
Eumetopias jubatus (Steller sea lion)	E	--	X
Family Phocidae			
Erignathus barbatus (bearded seal)	--	X	--
Odobenus rosmarus divergens (Pacific walrus)	--	X	--
Phoca fasciata (ribbon seal)	--	X	--
Phoca hispida (ringed seal)	--	X	--
Phoca largha (spotted seal)	--	X	--
Phoca vitulina richardsi (harbor seal)	--	--	X
Suborder Fissipedia (sea otters and polar bears)			
Family Mustelidae			
Enhydra lutris (sea otter)	E	--	X
Family Ursidae			
Ursus martimus (polar bear)	--	X	--

[a] Status: E = endangered under the Endangered Species Act of 1973; D = depleted stock (applies to Cook Inlet stock of belugas); S = strategic stock.

[b] Occurrence in and near OCS planning areas. Arctic refers to Beaufort Sea, Chukchi Sea, and Hope Basin Planning Areas; Subarctic refers to Gulf of Alaska and Cook Inlet Planning Areas.

Table 3-23. Terrestrial Mammals That Could Occur Adjacent to Alaska Planning Areas

Common Name	Scientific Name	Profiled in Text
barren-ground shrew	*Sorex ugyanak*	--
tundra shrew	*Sorex tundrensis*	--
dusky shrew	*Sorex monticolus*	--
arctic ground squirrel	*Spermophilus parryii*	--
brown lemming	*Lemmus trimucronatus*	--
collared lemming	*Dicrostonyx groenlandicus*	--
northern red-backed vole	*Clethrionomys rutilus*	--
tundra vole	*Microtus oeconomus*	--
singing vole	*Microtus miurus*	--
tundra hare	*Lepus othus*	--
least weasel	*Mustela nivalus*	--
short-tailed weasel	*Mustela erminea*	--
river otter	*Lutra canadensis*	X
red fox	*Vulpes vulpes*	--
arctic fox	*Alopex lagopus*	X
wolverine	*Gulo gulo*	--
coyote	*Canis latrans*	--
gray wolf	*Canis lupus*	--
black bear	*Ursus americanus*	X
grizzly bear	*Ursus arctos*	X
moose	*Alces alces*	--
barren-ground caribou	*Rangifer tarandus*	X
muskox	*Ovibos moschatus*	X
Sitka black-tailed deer	*Odocoileus hemionus sitkensis*	X

Table 3-24. Water Bird Species Occurring in the Alaska Planning Areas. (Some Rare and Accidental Species Are Not Included.)

Common Name	Scientific Name	ESA Status[a]	Occurrence[b]	
			Arctic	Subarctic
common loon	*Gavia immer*	--	Acc	U/B,W; C/M
Pacific loon	*Gavia pacifica*	--	C/B	U/B; C/M,W
red-throated loon	*Gavia stellata*	--	C/B	C/B,M; U,W
yellow-billed loon	*Gavia adamsii*	--	U/B	U/M; U/W
red-necked grebe	*Podiceps grisegena*	--	C/B	U/W
horned grebe	*Podiceps auritus*	--	C/B	U/W
tundra swan	*Cygnus columbianus*	--	U/B	C/M
trumpeter swan	*Cygnus buccinator*	--	R/B	C/B,M
greater white-fronted goose	*Anser albifrons*	--	C/B,M	C/B,M
snow goose	*Chen caerulescens*	--	U/B,C/M	C/M
emperor goose	*Chen canagica*	--	R	U/M,W
brant	*Branta bernicla*	--	C/B,M	U/M
Canada goose	*Branta canadensis*	T[c]	C/B	C/B,M
green-winged teal	*Anas crecca*	--	U/B	C/B,M
mallard	*Anas platyrhynchos*	--	R/B	C/B,M
northern pintail	*Anas acuta*	--	C/B,M	C/B,M
northern shoveler	*Anas spatula*	--	R/B	C/B,M
gadwall	*Anas strepera*	--	Acc	U/B
American wigeon	*Anas americana*	--	U/B	C/B,M
canvasback	*Aythya valisineria*	--	Acc	U/B,M
ring-necked duck	*Aythya collaris*	--	Acc	R/B,M
greater scaup	*Aythya marila*	--	U/B	C/B,M
lesser scaup	*Aythya affinis*	--	Acc	R/B,M,W
common eider	*Somateria mollissima*	--	C/B,M	U/B,M,W
king eider	*Somateria spectabilis*	--	C/B,M	U/M,W
spectacled eider	*Somateria fischeri*	T	U/B,M	Acc
Steller's eider	*Polysticta stelleri*	T	U/B,M	U-C/W
harlequin duck	*Histrionicus histrionicus*	--	R/B	C/B,M
long-tailed duck	*Clangula hyemalis*	--	C/B,M	C/M,W
black scoter	*Melanitta nigra*	--	Acc	C/M,W
surf scoter	*Melanitta perspicillata*	--	U/B	C/M,W
white-winged scoter	*Melanitta fusca*	--	U/B	C/B,M,W
common goldeneye	*Bucephala clangula*	--	Acc	R/B; C/M,W
Barrow's goldeneye	*Bucephala islandica*	--	--	C/B,M,W
bufflehead	*Bucephala albeola*	--	Acc	R/B; C/M,W
hooded merganser	*Lophodytes cucullatus*	--	--	R/B,M,W
common merganser	*Mergus merganser*	--	--	C/B,M,W
red-breasted merganser	*Mergus serrator*	--	R/B,M	C/B,M,W

[a] Federal status under the Endangered Species Act of 1973. Abbreviations: T = threatened.

[b] Occurrence information from Johnson and Herter (1989), Armstrong (1990), Isleib and Kessel (1973), U.S. Department of the Interior, Fish and Wildlife Service (1999a), and DeGange and Sanger (1986). Abbreviations: C = common, U = uncommon, R = rare, Acc = accidental, B = breeding bird, M = migration, and W = winter.

[c] The threatened designation applies only to a subspecies, the Aleutian Canada goose (*Branta canadensis leucopareia*). The U.S. Fish and Wildlife Service has proposed to remove this subspecies from the list of threatened and endangered wildlife.

Table 3-25. Shorebird Species Occurring in the Alaska Planning Areas. (Some Rare and Accidental Species Are Not Included.)

Common Name	Scientific Name	ESA Status[a]	Occurrence[b]	
			Arctic	Subarctic
black-bellied plover	*Pluvialis squatarola*	--	U/B	C/M
lesser golden-plover	*Pluvialis dominica*	--	C/B	C/M
semipalmated plover	*Charadrius semipalmatus*	--	U/B	C/B,M
black oystercatcher	*Haematopus bachmani*	--	--	C/B,M,W
greater yellowlegs	*Tringa melanoleuca*	--	Acc	C/B,M
lesser yellowlegs	*Tringa flavipes*	--	Acc	C/B,M
solitary sandpiper	*Tringa solitaria*	--	Acc	R/B; U/M
wandering tattler	*Heteroscelus incanus*	--	--	U/B; C/M
spotted sandpiper	*Actitis macularia*	--	--	C/B,M
whimbrel	*Numenius phaeopus*	--	U	C/M
Hudsonian godwit	*Limosa haemastica*	--	R	U/B,M
bar-tailed godwit	*Limosa lapponica*	--	U/B	U/B,M
ruddy turnstone	*Arenaria interpres*	--	C/B	C/M
black turnstone	*Arenaria melanocephala*	--	Acc	C/M; U/W
surfbird	*Aphriza virgata*	--	--	U/B; C/M
red knot	*Calidris canutus*	--	R/B	C/M
sanderling	*Calidris alba*	--	R/B	U/M; R/W
semipalmated sandpiper	*Calidris pusilla*	--	C/B	U/M
western sandpiper	*Calidris mauri*	--	U/B	C/M
least sandpiper	*Calidris minutilla*	--	U/B	C/B,M
white-rumped sandpiper	*Calidris fuscicollis*	--	R/B	Acc
baird's sandpiper	*Calidris bairdii*	--	C/B	U/M
pectoral sandpiper	*Calidris melanotos*	--	C/B	C/M
rock sandpiper	*Calidris ptilocnemis*	--	--	C/M,W
dunlin	*Calidris alpina*	--	C/B	C/M,W
stilt sandpiper	*Calidris himantopus*	--	U/B	R/M
buff-breasted sandpiper	*Tryngites subruficollis*	--	U/B	Acc
short-billed dowitcher	*Limnodromus griseus*	--	--	C/B,M
long-billed dowitcher	*Limnodromus scolopaceus*	--	C/B	C/M
common snipe	*Gallinago gallinago*	--	C/B	C/B,M; R/W
red-necked phalarope	*Phalaropus lobatus*	--	C/B	C/B,M
red phalarope	*Phalaropus fulicaria*	--	C/B	C/M

[a] Federal status under the Endangered Species Act of 1973.

[b] Occurrence information from Johnson and Herter (1989), Armstrong (1990), Isleib and Kessel (1973), and DeGange and Sanger (1987). Abbreviations: C = common, U = uncommon, R = rare, Acc = accidental, B = breeding bird, M = migration, and W = winter.

Table 3-26. Seabird Species Occurring in the Alaska Planning Areas. (Some Rare and Accidental Species Are Not Included.)

Common Name	Scientific Name	ESA Status[a]	Occurrence[b]	
			Arctic	Subarctic
short-tailed albatross	*Diomedea albatrus*	E		Acc
black-footed albatross	*Diomedea nigripes*	--		C/S,M
laysan albatross	*Diomedea immutabilis*	--		R/M
northern fulmar	*Fulmarus glacialis*	--	R/S	C/S,M; R/W
sooty shearwater	*Puffinus griseus*	--		C/S,M
short-tailed shearwater	*Puffinus tenuirostris*	--	R/S	U/S,M
fork-tailed storm petrel	*Oceanodroma furcata*	--		C/M
Leach's storm petrel	*Oceanodroma leucorboa*	--		U/S
double-crested cormorant	*Phalacrocorax auritus*	--		C/B,M; U/W
Brant's cormorant	*Phalacrocorax penicillatus*	--		R/S
pelagic cormorant	*Phalacrocorax pelagicus*	--	R/S	C/B,M,W
red-faced cormorant	*Phalacrocorax urile*	--		U/B,M,W
pomarine jaeger	*Stercorarius pomarinus*	--	U/B; C/M	C/M; R/S
parasitic jaeger	*Stercorarius parasiticus*	--	C/B	C/B,M
long-tailed jaeger	*Stercorarius longicaudus*	--	C/B	R/B,M
Bonaparte's gull	*Larus philadelphia*	--	Acc	C/B,M
mew gull	*Larus canus*	--	R/S,M	C/B,M,W
ring-billed gull	*Larus delawarensis*	--		R/S,M,W
herring gull	*Larus argentatus*	--	R/S,M	C/M; R/S,W
Thayer's gull	*Larus thayeri*	--	R/M	R/S,W,M
glaucous-winged gull	*Laurs glaucescens*	--	Acc	C/B,M,W
glaucous gull	*Larus hyperboreus*	--	C/B,M	R/S,W,M
black-legged kittiwake	*Rissa tridactyla*	--	C/S,	C/B,M; U/W
Ross's gull	*Rhodostethia rosea*	--	C/M	Acc
Sabine's gull	*Xema sabini*	--	C/B,M	U/M; R/S
arctic tern	*Sterna paradisaea*	--	C/B	C/B,M
Aleutian tern	*Sterna aleutica*	--	Acc	U/B,M
common murre	*Uria aalge*	--	Acc	U/B,M,W
thick-billed murre	*Uria lomvia*	--	R/B	R/M,W
black guillemot	*Cepphus grylle*	--	U/B	
pigeon guillemot	*Cepphus columba*	--		C/B,M,W
marbled murrelet	*Brachyramphus marmoratus*	--		C/M,W
Kittlitz's murrelet	*Brachyramphus brevirostris*	--	R	C/S; U/W
ancient murrelet	*Synthliboramphus antiquus*	--		U/S,M,W
Cassin's auklet	*Ptychoramphus aleuticus*	--		R/S,M
parakeet auklet	*Cyclorrhynchus psittacula*	--	Acc	R/B,M
crested auklet	*Aethia cristatella*	--	R/S	U/S,W
rhinoceros auklet	*Cerorhinca monocerata*	--		R/S,M
tufted puffin	*Fratercula cirrhata*	--	Acc	C/B,M; R/W
horned puffin	*Fratercula corniculata*	--	R/S	U/B,M; R/W

[a] Federal status under the Endangered Species Act of 1973. Abbreviations: E = endangered.

[b] Occurrence information from Johnson and Herter (1989), Armstrong (1990), DeGange and Sanger (1987), and Isleib and Kessel (1973). Abbreviations: C = common, U = uncommon, R = rare, Acc = accidental, B = breeding bird, M = migration, W = winter, and S = summer.

Table 3-27. Species for Which Essential Fish Habitat Has Been Designated in the Gulf of Alaska and Cook Inlet

Forage Fish	Groundfish	Flatfish	Rockfish	Salmon	Scallops
rainbow smelt	skates	yellowfin sole	thornyhead	sockeye	weathervane
eulochon	sculpin	rock sole	yelloweye	pink	pink scallops
capelin	sablefish	rex sole	shortraker and rougheye	coho	spiny scallops
sand lance	Pacific cod	Greenland turbot	Pacific ocean perch	chum	
myctophids	atka mackerel	flathead sole	northern	king	
bathylagids	walleye pollock	Dover sole	dusky		
sand fish	sharks	arrowtooth flounder			
euphausiids	octopus	Alaska plaice			
pholids	red squid				
stichaeids					
gonostomatids					

Note: Essential fish habitat for crab species designated for the Bering Sea Aleutian Islands but not for Gulf of Alaska and Cook Inlet Planning Areas, so they are not included in table.

Table 3-28. Alaska Comparative Population and Income Measures

Geographical Area	1970	1980	1990	1998
State of Alaska				
median age of population	22.9	26.1	29.6	32.4
income factors				
number of families	66,670	96,840	134,806	
median income	$12,507	$28,395	$46,581	
mean income			$54,200	
per capita income			$21,191	$24,969
poverty factors				
no. families below poverty level	6,199	NA	9,198	
% persons below poverty level	13%	16%	9%	
Beaufort Sea Planning Area				
median age of population	20.6	24.7	26.6	27.0
income factors				
number of families	433	994	1,688	
median income	$8,575	$31,378	$50,473	
mean income	$9,408	$35,507	$58,845	
per capita income			$23,422	$23,637
poverty factors				
no. families below poverty level	120	81	101	
% persons below poverty level	32%	11%	9%	
Gulf of Alaska Planning Area				
median age of population	NA	26.5	30.8	34+
income factors				
number of families	448	461	1,004	
median income	$11,414	$7,528	$43,693	
mean income	$11,131	$13,416	$48,180	
per capita income			$21,151	$23,056
poverty factors				
no. families below poverty level	85	82	63	
% persons below poverty level	11%	13%	9%	
Chukchi Sea and Hope Basin Planning Areas				
Nome Census Area median age of population	NA	23.4	26.4	26.7
income factors				
number of families	1,010	1,758	2,407	
median income	$7,340	$14,550	$30,144	
mean income	$9,253	$19,728	$36,654	
per capita income			$13,864	$18,008
poverty factors				
no. families below poverty level	315	326	337	
% persons below poverty level	35%	28%	22%	

Table 3-28. Alaska Comparative Population and Income Measures (continued)

Geographical Area	1970	1980	1990	1998
Chukchi Sea and Hope Basin Planning Areas (cont.)				
Kobuk Census Area/NW Arctic Bor. median age of population	< 17	21.5	22.9	22.9
income factors				
number of families	694	1,149	1,543	
median income	$6,571	$17,756	$33,313	
mean income	$8,239	$21,069	$39,885	
per capita income			$14,672	$18,938
poverty factors				
no. families below poverty level	224	218	205	
% persons below poverty level	35%	27%	19%	
Cook Planning Area				
Kenai-Cook Inlet Census Area/Kenai Pen. Bor. median age of population	NA	26.3	31.3	35.4
income factors				
number of families	3,344	8,656	14,323	
median income	$12,969	$23,660	$42,403	
mean income	$14,150	$27,901	$50,816	
per capita income			$21,102	$22,979
poverty factors				
no. families below poverty level	239	568	640	
% persons below poverty level	9%	12%	8%	
Municipality of Anchorage median age of population	NA	26.3	30.1	32.1
income factors				
number of families	29,992	60,826	83,043	
median income	$13,593	$27,375	$43,946	
mean income	$15,059	$32,073	$52,809	
per capita income			$24,664	$29,343
poverty factors				
no. families below poverty level	1499	2677	3116	
% persons below poverty level	7%	7%	7%	

Source: U.S. Department of Commerce, Bureau of the Census (1973, 1983, 1992); Alaska Department of Labor (2000b); Williams (2000).

Table 3-29. State of Alaska Population Projections by Age, 1998-2025

Age	1998	2000	2005	2006	2010	2015	2020	2025
0-4	52,036	51,000	53,000	54,000	59,000	66,000	70,000	71,000
5-9	57,823	56,000	54,000	54,000	56,000	62,000	69,000	73,000
10-14	55,756	59,000	59,000	58,000	57,000	58,000	65,000	72,000
15-19	48,622	52,000	58,000	59,000	58,000	56,000	57,000	64,000
20-24	34,485	38,000	47,000	48,000	52,000	52,000	50,000	52,000
25-29	39,401	35,000	40,000	43,000	51,000	57,000	56,000	54,000
30-34	49,539	47,000	37,000	36,000	43,000	53,000	59,000	59,000
35-44	120,347	117,000	103,000	98,000	84,000	79,000	95,000	111,000
45-54	89,752	99,000	111,000	112,000	109,000	96,000	78,000	74,000
55-59	24,826	27,000	40,000	42,000	48,000	50,000	46,000	39,000
60-64	16,119	18,000	25,000	26,000	36,000	43,000	45,000	41,000
65+	32,694	36,000	44,000	47,000	58,000	78,000	103,000	124,000
Total	**621,400**	**635,000**	**670,000**	**679,000**	**709,000**	**751,000**	**793,000**	**833,000**
median age	32.4	32.9	33.4	33.2	32.4	32.2	32.4	32.7
males/100 females	108.3	107.9	106.8	106.6	105.8	104.7	103.8	102.9
youth dependency	50.2	49.6	47.7	47.5	46.5	48.9	53.2	56.6
aged dependency	8.3	8.9	10.5	10.9	13.0	17.4	22.7	27.5

Source: Alaska Department of Labor (1998).

Table 3-30. Alaska Population and Employment Composition

Population Variable	1970	1980	1990	1998	
total population	300,382	401,851	550,043	621,400	
percent change from previous period		33.8	36.9	13.0	
Age Structure (%)					
0 – 5	10.7	9.7	9.9	8.4	
6 – 15	23.6	17.2	17.2	18.3	
16 – 17	8.9	9.2	4.1	7.8	
18 – 24	11.8	11.2	2.6	5.5	
25 – 34	16.4	22.7	17.0	14.3	
35 – 44	12.7	13.4	21.5	19.4	
45 – 54	9.0	8.4	14.3	14.4	
55 – 64	4.6	5.3	7.1	6.6	
65 +	2.3	2.8	6.3	5.3	
Race and Ethnic Composition (%)					
White	78.8	77.6	75.5	73.9	
American Native	5.4	16.0	15.6	16.8	
African American	3.0	3.4	4.1	4.4	
Asian/Pacific Islander	0.9	2.1	3.6	4.9	
Other	11.9	0.9	1.2	0.0	
Education of Persons Age 25+ (%)					
number of persons	134,948	211,397	323,429		
0 - 8 years schooling	18.4	9.0	5.1		
9 - 11 years schooling	14.9	8.5	8.2		
high school graduates	37.7	38.9	28.7		
13 –15 years schooling	14.9	22.6	34.9		
college graduates or more	14.1	21.1	23.0		
Labor Force Size (%)					
civilian	76.6	89.3	91.5		
military	23.4	10.7	8.5		
total (number)	131,553	204,682	293,957		
Employment by Occupation Sector (%)					
management and professional	24.6	28.6	30.0		
technical, sales, administrative support	34.6	30.5	30.7		
precision production, craft, repair	11.4	12.5	11.2		
operatives, fabricators, laborers	11.5	11.2	11.0		
farming, forestry, fishing	1.6	3.7	2.7		
service occupations	16.3	13.4	14.4	**ADOL Data**	
Employment by Industry Group (%)				**1990**	**1998**
agriculture, forestry, fishing	1.8	3.1	3.5	0.5	0.5
mining	2.5	2.9	3.6	4.9	3.8
construction	8.8	8.0	6.6	4.4	4.9
manufacturing	7.1	6.3	5.9	7.3	5.3
transportation, communications, utilities	11.6	11.2	10.7	8.7	9.4
wholesale and retail trade	18.8	17.6	19.2	19.5	20.8
finance	3.7	5.1	4.6	3.9	4.2
services	45.7	46.0	45.8	21.1	24.7
nonclassifiable (1998 ADOL data only)	--	--	--	0.3	0.1
total Government (1998 ADOL data only)	--	--	--	29.5	26.3

Source: U.S. Department of Commerce, Bureau of the Census (1973, 1983, 1992); Alaska Department of Labor (ADOL) (2000a,b).

Table 3-31. Beaufort Sea Planning Area Population and Employment Composition

Population Variable	1970	1980	1990	1998
total population	2,663	4,199	5,979	7,403
percent change from previous period		57.7	42.4	23.8
Age Structure (%)				
0 – 5	11.1	9.8	13.9	9.6
6 – 15	28.7	17.7	19.6	25.0
16 – 17	8.9	12.1	4.1	8.4
18 – 24	10.7	11.1	2.2	4.9
25 – 34	13.8	20.9	17.2	13.4
35 – 44	11.2	11.5	17.9	16.8
45 – 54	5.1	8.8	12.6	11.9
55 – 64	5.9	4.5	7.2	5.9
65 +	4.6	3.6	5.3	4.0
Race and Ethnic Composition (%)				
White	12.4	21.8	21.3	30.7
American Native	0.4	76.8	72.5	56.2
African American	0.5	0.3	0.7	1.7
Asian/Pacific Islander	0.1	0.8	4.8	11.4
Other	86.6	0.2	0.7	0.0
Education of Persons Age 25+ (%)				
number of persons	1033	960	3183	--
0 - 8 years schooling	72.5	9.2	19.0	--
9 - 11 years schooling	8.4	12.9	12.5	--
high school graduates	9.0	39.1	30.5	--
13 –15 years schooling	3.6	19.1	23.9	--
college graduates or more	6.5	19.8	14.1	--
Labor Force Size (%)				
civilian	84.9	92.3	99.7	--
military	15.1	7.7	0.3	--
total (number)	713	2,031	2,964	--
Employment by Occupation Sector (%)				
management and professional	21.3	21.3	27.0	--
technical, sales, administrative support	15.5	20.6	26.4	--
precision production, craft, repair	18.5	22.7	15.7	--
operatives, fabricators, laborers	26.4	14.9	13.6	--
farming, forestry, fishing	0.0	0.7	0.2	--
service occupations	18.2	19.8	17.2	
Employment by Industry Group (%)[1]				
agriculture, forestry, fishing	0.0	1.0	0.6	0.0
mining	10.1	5.1	4.9	45.4
construction	3.4	22.4	13.9	4.4
manufacturing	0.7	1.4	1.3	0.1
transportation, communications, utilities	12.2	11.7	12.1	5.1
wholesale and retail trade	12.0	7.8	8.1	6.5
finance	1.3	3.6	1.9	2.1
services	60.3	47.1	57.1	12.2
nonclassifiable (1998 ADOL data only)	--	--	--	0.0
total government (1998 ADOL data only)	--	--	--	24.3

Source: U.S. Department of Commerce, Bureau of the Census (1973, 1983, 1992).

[1] 1998 data: Alaska Department of Labor (ADOL) (2000a,b).

Table 3-32. Chukchi Sea and Hope Basin Planning Areas Population and Employment Composition

Population Variable	1970	1980	1990	1998
total population	10,217	11,368	14,401	16,246
percent change from previous period		11.3	26.7	12.8
Age Structure (%)				
0 – 5	12.7	11.5	14.1	11.2
6 – 15	30.6	21.4	21.4	24.6
16 – 17	10.7	11.7	4.7	8.5
18 – 24	7.3	10.3	2.8	5.5
25 – 34	12.4	17.4	15.9	12.9
35 – 44	9.4	9.7	16.6	15.6
45 – 54	7.9	8.1	10.0	10.6
55 – 64	5.2	5.1	7.0	5.4
65 +	3.9	5.0	7.3	5.6
Race and Ethnic Composition (%)				
White	17.1	17.6	19.9	15.3
American Native	0.3	81.9	78.9	83.5
African American	0.3	0.2	0.1	0.4
Asian/Pacific Islander	0.2	0.2	0.7	0.9
Other	82.2	0.1	0.4	0.0
Education of Persons Age 25+ (%)				
number of persons	3,940	8,182	7,195	--
0 - 8 years schooling	63.8	20.7	23.2	--
9 - 11 years schooling	8.4	10.2	12.3	--
high school graduates	13.1	34.9	32.6	--
13 –15 years schooling	6.7	19.0	18.9	--
college graduates or more	8.2	16.5	13.1	--
Labor Force Size (%)				
civilian	89.6	97.7	98.5	--
military	10.4	2.3	1.5	--
total (number)	2,453	3,844	5,422	--
Employment by Occupation Sector (%)				
management and professional	38.1	34.2	32.5	--
technical, sales, administrative support	16.5	27.1	29.4	--
precision production, craft, repair	11.2	10.0	9.6	--
operatives, fabricators, laborers	14.6	7.9	0.0	--
farming, forestry, fishing	0.7	0.7	0.8	--
service occupations	18.9	20.1	18.7	
Employment by Industry Group (%)[1]				
agriculture, forestry, fishing	1.5	0.6	0.9	0.1
mining	2.9	2.0	4.6	7.2
construction	3.9	4.5	3.4	2.3
manufacturing	2.2	1.6	1.2	0.4
transportation, communications, utilities	13.7	11.4	12.1	9.3
wholesale and retail trade	14.3	11.9	15.6	10.6
finance	0.4	2.5	1.9	6.2
services	61.1	65.4	60.3	27.0
nonclassifiable (1998 ADOL data only)	--	--	--	0.0
total government (1998 ADOL data only)	--	--	--	37.0

Source: U.S. Department of Commerce, Bureau of the Census (1973, 1983, 1992).
[1] 1998 data: Alaska Department of Labor (ADOL) (2000a,b).

Table 3-33. Cook Inlet Planning Area Population and Employment Composition

Population Variable	1970	1980	1990	1998
total population	138,792	199,713	267,140	307,597
percent change from previous period		43.9	33.8	15.1
Age Structure (%)				
0 – 5	10.6	9.4	9.4	8.3
6 – 15	27.5	16.9	16.3	17.4
16 – 17	8.5	8.9	4.2	7.5
18 – 24	6.8	11.3	2.6	5.7
25 – 34	17.2	23.3	16.9	15.0
35 – 44	14.9	14.1	22.0	19.6
45 – 54	9.5	8.7	15.0	14.6
55 – 64	3.7	5.2	7.5	6.6
65 +	1.4	2.1	6.1	5.2
Race and Ethnic Composition (%)				
White	90.8	86.6	82.3	79.9
American Native	1.6	5.4	6.5	7.9
African American	3.8	4.7	5.5	6.2
Asian/Pacific Islander	0.8	2.2	4.2	6.1
Other	3.0	1.0	1.4	0.0
Education of Persons Age 25+ (%)				
number of persons	6351	106,714	161,078	--
0 - 8 years schooling	10.3	4.6	3.0	--
9 - 11 years schooling	14.9	7.8	7.1	--
high school graduates	42.4	40.2	26.7	--
13 –15 years schooling	17.1	24.7	37.7	--
college graduates or more	15.3	22.7	25.5	--
Labor Force Size (%)				
civilian	78.6	89.7	92.8	--
military	21.4	10.3	7.2	--
total (number)	625,98	106,888	149,507	--
Employment by Occupation Sector (%)				
management and professional	31.2	79.3	31.2	--
technical, sales, administrative support	27.3	10.1	33,7	--
precision production, craft, repair	15.4	3.5	10.5	--
operatives, fabricators, laborers	12.8	3.0	9.2	--
farming, forestry, fishing	0.2	0.4	1.5	--
service occupations	13.2	3.7	13.9	
Employment by Industry Group (%)[1]				
agriculture, forestry, fishing	0.7	1.7	0.3	0.5
mining	3.5	4.2	0.7	3.5
construction	10.4	8.0	0.8	5.4
manufacturing	4.0	3.9	0.6	2.6
transportation, communications, utilities	11.4	11.6	1.5	10.1
wholesale and retail trade	21.2	19.6	2.8	24.0
finance	5.0	7.2	74.7	4.9
services	43.6	43.7	18.6	26.7
nonclassifiable (1998 ADOL data only)	--	--	--	0.0
total government (1998 ADOL data only)	--	--	--	22.2

Source: U.S. Department of Commerce, Bureau of the Census (1973, 1983, 1992).

[1] 1998 data: Alaska Department of Labor (ADOL) (2000a,b).

Table 3-34. Gulf of Alaska Planning Area Population and Employment Composition

Population Variable	1970	1980	1990	1998
total population	2,157	3,478	4,385	4,474
percent change from previous period		61.2	26.1	2.0
Age Structure (%)				
0 – 5	11.3	11.0	8.9	6.1
6 – 15	21.8	17.9	19.2	17.1
16 – 17	11.2	9.0	4.6	8.2
18 – 24	6.2	8.3	1.9	4.5
25 – 34	18.2	22.3	13,7	11.4
35 – 44	7.5	12.0	22.0	19.8
45 – 54	8.1	6.9	14.0	17.4
55 – 64	10.2	7.3	7.9	9.3
65 +	5.5	5.3	7.8	6.3
Race and Ethnic Composition (%)				
White	62.0	56.3	60.4	54.4
American Native	34.9	42.0	38.1	45.1
African American	0.0	0.0	0.2	0.0
Asian/Pacific Islander	0.6	0.8	0.7	0.5
Other	2.5	0.9	0.6	0.0
Education of Persons Age 25+ (%)				
number of persons	1002	1873	2655	--
0 - 8 years schooling	31.9	12.1	6.3	--
9 - 11 years schooling	14.8	17.0	14.4	--
high school graduates	32.1	41.2	36.2	--
13 –15 years schooling	10.0	15.1	27.3	--
college graduates or more	11.2	14.7	15.8	--
Labor Force Size (%)				
civilian	97.2	99.7	99.9	--
military	2.8	0.3	0.1	--
total (number)	748	1,558	2,344	--
Employment by Occupation Sector (%)				
management and professional	27.8	24.6	22.4	--
technical, sales, administrative support	14.0	24.5	18.2	--
precision production, craft, repair	16.5	14.4	10.3	--
operatives, fabricators, laborers	24.8	19.7	17.5	--
farming, forestry, fishing	0.0	5.5	15.7	--
service occupations	17.0	11.4	15.9	
Employment by Industry Group (%)[1]				
agriculture, forestry, fishing	2.2	4.6	10.3	0.1
mining	0.0	1.2	0.5	0.0
construction	1.9	4.3	4.8	3.3
manufacturing	6.0	9.3	24.9	16.8
transportation, communications, utilities	33.3	21.8	12.2	9.8
wholesale and retail trade	18.4	13.4	14.5	16.9
finance	2.2	1.9	0.9	2.2
services	36.1	43.6	31.9	19.6
nonclassifiable (1998 ADOL data only)	--	--	--	0.0
total government (1998 ADOL data only)	--	--	--	31.3

Source: U.S. Department of Commerce, Bureau of the Census (1973, 1983, 1992).

[1] 1998 data: Alaska Department of Labor (ADOL) (2000a,b).

Table 3-35. Threatened or Endangered Marine Mammals in the Pacific Region

Species	Status[a]
ORDER CETACEA	
Suborder Mysticeti (baleen whales)	
Family Balaenidae	
Balaena (Eubalaena) glacialis (includes *australis*) (right whale)	E
Family Balaenopteridae	
Balaenoptera borealis (sei whale)	E
Balaenoptera musculus (blue whale)	E
Balaenoptera physalus (fin whale)	E
Megaptera novaeangliae (humpback whale)	E
Suborder Odontoceti (toothed whales and dolphins)	
Family Physeteridae	
Physeter macrocephalus (sperm whale)	E
ORDER CARNIVORA	
Family Otariidae	
Arctocephalus townsendi (Guadalupe fur seal)	T
Eumetopias jubatus (Steller [=northern] sea lion)	T[b]
Family Mustelidae	
Enhydra lutris nereis (southern sea otter)	T[c]

Sources: State of California, The Resources Agency, Department of Fish and Game (2000); U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (2001a).

[a] Status: E = endangered, T = threatened under the Endangered Species Act of 1973. Individual Pacific states (e.g., California, Washington) may also designate individual marine mammal species as endangered, threatened, rare, or candidate species under state law.

[b] The Steller sea lions inhabiting the Pacific OCS Region belong to the eastern population, which is still listed as threatened. The western population, all of which is in Alaska, was reclassified as endangered in 1997.

[c] Only the southern California population of the sea otter is threatened. A population established in Washington using translocated Alaskan sea otters is not federally listed.

Table 3-36. Marine Resources of Concern in California

Northern California	Central California	Southern California
Redwood National Park ASBS	Central California Biosphere Reserve	Channel Islands Biosphere Reserve*
Redwood National Park	Gulf of the Farallones NMS*	Channel Islands NMS*
Kelp Beds at Trinidad Head ASBS	Pt. Reyes National Seashore	Channel Islands National Park*
Kings Range MRPA Ecological Reserve	Bird Rock ASBS*	Santa Barbara Channel Ecological Preserve*
King Range National Conservation Area ASBS	Pt. Reyes Headlands Reserve and Extension Area ASBS*	San Miguel Island Ecological Reserve*
MacKerricher State Park	Pt. Reyes Headlands Reserve*	Santa Barbara Island Ecological Reserve*
Pygmy ASBS	Pt. Reyes Headlands National Research Natural Area*	Anacapa Island Ecological Reserve*
Pt. Cabrillo Reserve	Double Point ASBS*	San Miguel, Santa Rosa, and Santa Cruz Islands ASBS*
Russian Gulch State Park	Duxbury Reef ASBS*	Santa Barbara and Anacapa Islands ASBS*
Van Damme State Park	Duxbury Reef Reserve*	San Nicolas and Begg Rock ASBS*
Manchester State Park	Farallon Island ASBS*	Big Sycamore Canyon MRPA Ecological Reserve
Arena Rock Natural Preserve	Farallon Islands Game Refuge*	Mugu Lagoon to Latigo Point ASBS
Kelp Beds at Saunders Reef ASBS	Monterey Bay NMS	Abalone Cove Ecological Reserve
Del Mar Landing Ecological Reserve ASBS	Golden Gate National Recreation Area	Point Fermin Marine Life Refuge*
Del Mar Landing Ecological Reserve	James V. Fitzgerald Marine Reserve ASBS	Santa Catalina Island-Subarea One
Salt Point State Park	James V. Fitzgerald Marine Reserve	Catalina Science Marine Life Refuge
Gerstle Cove ASBS	Ano Nuevo Point and Island ASBS	Santa Catalina Island-Subarea Two
Gerstle Cove Reserve	Pacific Grove Marine Gardens Fish Refuge and Hopkins Marine Life Refuge ASBS	Santa Catalina Island-Subarea Three
Fort Ross State Historic Park	Hopkins Marine Life Refuge	Farnsworth Bank Ecological Reserve
Sonoma Coast State Beach	Pacific Grove Marine Gardens Fish Refuge	Lovers Cove Reserve
Bodega Marine Life Refuge ASBS	Carmel Bay Ecological Reserve ASBS	Santa Catalina Island-Subarea Four
Bodega Marine Life Refuge	Carmel Bay Ecological Reserve	San Clemente Island ASBS
Cordell Banks NMS	California Sea Otter Game Refuge	Newport Marine Life Refuge

Table 3-36. Marine Resources Of Concern In California (continued)

Northern California	Central California	Southern California
	Point Lobos Ecological Reserve ASBS	Newport Marine Life Refuge ASBS
	Point Lobos Ecological Reserve	Crystal Cove State Park
	Point Lobos Reserve	Irvine Coast Marine Life Refuge
	Julia Pfeiffer Burns Underwater Park ASBS	Irvine Coast Marine Life Refuge ASBS
	Julia Pfeiffer Burns State Park	Laguna Beach Marine Life Refuge
	Big Creek MRPA Ecological Reserve	Heisler Park Ecological Reserve
	Ocean Area Surrounding the Mouth of Salmon Creek ASBS	Heisler Park Ecological Reserve ASBS
	Atascadero Beach Pismo Clam Preserve (Clam Refuge)	South Laguna Beach Marine Life Refuge
	Morro Beach Pismo Clam Preserve (Clam Refuge)	Niguel Marine Life Refuge
	Pismo Invertebrate Reserve	Dana Point Marine Life Refuge
	Pismo-Oceano Beach Pismo Clam Preserve (Clam Refuge)	Doheny State Beach
	Vandenberg MRPA Ecological Reserve	Doheny Marine Life Refuge
		City of Encinitas Marine Life Refuge
		Cardiff and Elijo State Beaches
		San Diego-La Jolla City Underwater Park
		San Diego Marine Life Refuge
		Scripps Coastal Reserve
		San Diego Marine Life Refuge ASBS
		San Diego-La Jolla Ecological Reserve
		San Diego-La Jolla Ecological Reserve ASBS
		Cabrillo National Monument
		Point Loma Reserve

Abbreviations: ASBS = area of special biological significance; MRPA = Marine Resources Protection Act; and NMS = national marine sanctuary.

Note (1): Resources denoted by an asterisk (*) may be at greater risk of oil-spill impact due to their location relative to port operations at Los Angeles and San Francisco, or vessel traffic lanes approaching these ports.

Note (2): In addition to federally or State-designated parks and/or monuments, the State of California has established a broad category for unique, sensitive, or valuable marine resource areas, including ASBS's,, ecological reserves, marine life refuges, and reserves and preserves. Combined, these marine resources have been designated as California Marine Protected Areas (CMPA's). While there may be some overlap in the future, CMPA's should be considered distinct from (yet to be federally-designated) marine protected areas (MPA's). The mechanism for establishing MPA's was implemented by President Clinton under Executive Order 13198 in May 2000.

Table 4-1a. The Proposed Action (Alternative 1) - Exploration and Development Scenario for the Gulf of Mexico Region

Scenario Elements	Gulf of Mexico Region		
	Western	Central	Eastern
Sales	5	5	2
Oil Production (BBO)	0.68 – 1.31	1.38 – 3.27	0.10 – 0.17
Gas Production (Tcf)	4.05 – 7.20	7.95 – 16.50	0.405 – 0.68
Years of Activity	40	40	40
Platforms	50 – 75	130 – 240	2 – 3
Exploration and Delineation Wells	185 – 575	555 – 1,235	17 – 26
Development and Production Wells	490 - 825	890 – 1,760	30 – 52
Miles of Pipeline	500 – 1,500	800 – 2,400	200 – 350
Landfalls	0 - 5	0 – 5	1 – 2 (gas only)
Vessel Trips/Week	60 – 100	175 – 350	3 – 5
Helicopter Trips/Week	75 – 125	225 – 425	4 – 6
New Shore Bases	0 - 3	0 – 1	0
New Process Facilities	0	0	0
New Waste Facilities	2	4	0
Drill Muds/Well (bbl)			
Exploration/Delineation	7,860	7,860	7,860
Development/Production	5,800	5,800	5,800
Drill Cuttings/Well (bbl)			
Exploration/Delineation	2,680	2,680	2,680
Development/Production	1,630	1,630	1,630
Produced Water/Well (bbl)			
Oil Well	450	450	450
Gas Well	68	68	68
Bottom Area Disturbed – Platforms (ha)	75 – 115	200 – 350	4 – 6
Bottom Area Disturbed – Pipeline (ha)	700 – 2,000	1,100 – 3,300	280 – 490
Platform Removals with Explosives	40 – 60	100 – 190	0

Table 4-1b. The Proposed Action (Alternative 1) - Exploration and Development Scenario for the Alaska Region

Scenario Elements	Alaska Region				
	Beaufort Sea	Chukchi Sea	Hope Basin	Cook Inlet	Norton Basin
Sales	3	2	2	2	1
Oil Production (BBO)	1.02 – 1.71	0.96 - 2.42	0.010 – 0.020 (condensate)	0.28 – 0.34	0.005 – 0.008 (condensate)
Gas production (Tcf)	None	None	0.290 – 0.714	0.38 – 0.58	0.260 – 0.400
Years of Activity	30	35	25	35	20
Platforms	6 – 12	2 - 8	2	2 – 6	1
Exploration and Delineation Wells	18 – 30	6 – 24	6 – 10	8 – 18	3 – 5
Development and Production Wells	190 – 325	106 - 320	8 – 18	84 – 108	7 – 10
Miles of Onshore Pipeline	60 – 120	330	0	75	0
Miles of Offshore Pipeline	125 - 160	100 - 260	50 – 100	40 – 125	25 – 55
Landfalls	2	1	1	2 – 4	1
Vessel Trips/Week	3 – 6	1 - 4	1	2 – 8	1
Helicopter Trips/Week	30 – 60	10 - 40	10	10 – 40	5
New Shore Bases	0	1	1	0	1
New Process Facilities	2	1	1	0	1
New Waste Facilities	0	1	1	0	1
Drill Muds/Well (bbl)					
Exploration/Delineation	255	565	350	435	565
Development/Production	290	320	200	220	380
Drill Cuttings/Well (bbl)					
Exploration/Delineation	1,520	1,970	940	1,275	1,970
Development/Production	2,550	2,830	1,520	1,600	3,335
Bottom Area Disturbed – Platforms (ha)	18 – 36	6 - 24	6	4 – 12	3
Bottom Area Disturbed – Pipelines (ha)	95 - 120	75 - 195	40 - 75	30 - 95	20 – 40
Platform Removals with Explosives	0	0	0	0	0

Assumptions

- All cuttings from exploration and delineation wells will be discharged at the offshore well site.
- All cuttings from production and development wells will be disposed of subsurface.
- 80% of drilling muds will be recycled.
- 20% of drilling muds for exploration and delineation wells will be discharged at the well site.
- All spent drilling muds for production and development wells will be disposed of subsurface or at onshore waste disposal sites.
- All produced water will be reinjected.

Table 4-1c. Oil-Spill Rates for Spill Sources (Spill/Billion Barrels)

Spill Source	Spills ≥ 1,000 bbl		Spills ≥ 10,000 bbl	
	Spill Rate Entire Record[1]	Spill Rates for Last 15 Years[2]	Spill Rates Entire Record[1]	Spill Rates for Last 15 Years[2]
OCS Platforms	0.32	<0.13	0.12	<0.05
OCS Pipelines	1.33	1.38	0.33	0.34
Tankers US Waters	1.03	0.72	0.43	0.25
ANS[3] Crude Tankers	0.88	0.92	0.23	0.34

NOTE: Spill rates are expressed as number of spills (greater than or equal to a certain size) per billion bbl handled. Spills ≥ 10,000 bbl are a subset of spills ≥ 1,000 bbl. Billion bbl = 1,000,000,000 bbl.

[1] Entire record: OCS Platforms & Pipelines spill rates calculated on 1964-1999 data; Tankers in US Waters and ANS tankers spill rates calculated on 1974-1999 data.

[2] Last 15 Years: spill rates calculated on 1985-1999 data.

[3] ANS = Alaska North Slope crude oil tankers, spill rates based on historic spills from carries of ANS crude.

Source: Anderson and LaBelle (2001).

Table 4-1d. Oil-Spill Rates for OCS Planning Areas (by Production/Transportation)

Region	Production/Transportation Scenario	Entire Record	Last 15 Years[2]
Spills ≥ 1,000 bbl			
WGOM, CGOM	100% Platform, 90% Pipeline 10% Tanker U.S. Waters	1.62	1.44
EGOM, Cook Inlet	100% Platform, 100% Pipeline	1.65	1.51
Beaufort, Chukchi Norton Basin	100% Platform, 100% Pipeline, 100% ANS[3] Tankers	2.53	2.43
Spills ≥ 10,000 bbl			
WGOM, CGOM	100% Platform, 90% Pipeline 10% Tanker U.S. Waters	0.46	0.38
EGOM, Cook Inlet	100% Platform, 100% Pipeline	0.45	0.39
Beaufort, Chukchi Norton Basin	100% Platform, 100% Pipeline, 100% ANS[3] Tankers	0.68	0.73
Spills ≥ 500[3] bbl using Onshore North Slope Rate & Trans-Alaska Pipeline System (TAPS) Rate			
1985-1998: facilities-0.48, pipelines-0.12, Total 0.60 spills/Bbbl		1985-1998: TAPS-0.12 spills/Bbbl	
Beaufort, Chukchi Norton Basin	100% Platform, 100% Pipeline 100% TAPS, 100% ANS[4] crude tankers 1,000+ bbl spills		1.64
Cook Inlet	100% Platform, 100% Pipeline, no TAPS, no ANS[4] Tankers		0.60

Note: Spill rates are expressed as number of spills (greater than or equal to a certain size) per billion barrels (Bbbl) handled (Bbbl = 1,000,000,000 bbl). Spills ≥ 10,000 bbl are a subset of spills ≥ 1,000 bbl.

[1] Entire record: OCS platforms & pipelines spill rates calculated on 1964-1999 data; tankers in U.S. waters and ANS tankers spill rates calculated on 1974-1999 data; OCS platform and pipeline data is based on U.S. Gulf of Mexico and offshore California data.

[2] Last 15 Years: spill rates calculated on 1985-1999 data.

[3]ANS = Alaska North Slope crude tankers, spill rates based on historic spills from carries of ANS crude.

[4] Areas in Alaska have an alternative estimate of the number of spills likely to occur by using Alaska data for the platform and pipeline spill occurrence estimates. Estimates of the mean number of spills and the probability of one or more spills occurring using Alaska rates are based on spill rates calculated on 1985-1998 data of 500 bbl and greater from Alaska Onshore North Slope facilities and pipelines in the TAPS. Using these rates as a proxy for spills >1,000 bbl is conservative, i.e., they should result in an overestimate of the number of spills of 1,000 barrels or greater since spill occurrence frequency varies inversely to spill size. Spill rates from ANS Crude tanker spills ≥ 1,000 bbl were also used for areas where the oil is assumed to be transported by tanker from Alaska to the U.S. west coast.

Source: Anderson and LaBelle (2001).

Table 4.1e. The Proposed Action (Alternative 1) – Oil-Spill Assumptions

Scenario Elements	Gulf of Mexico Region: Western	Gulf of Mexico Region: Central	Gulf of Mexico Region: Eastern	Alaska Region: Beaufort Sea	Alaska Region: Chukchi Sea	Alaska Region: Cook Inlet	Alaska Region: Gulf of Alaska	Pacific Region
Oil Production (BBO)	0.68-1.31	1.38-3.27	0.10 – 0.17	1.02-1.71	0.96- 2.42	0.28-0.34	0	0
Years of Activity	40	40	40	35	40	25	N/A	N/A
Large oil spills from OCS activity*	1 shallow platform spill 1 deep pipeline spill	1 shallow platform spill 1 shallow, 1 deep pipeline spills 1 deep tanker spill	1 shallow pipeline spill	1 platform spill 1 pipeline spill	1 platform spill 2 pipeline spills in Chukchi	1 pipeline spill	1 tanker spill (Arctic OCS production)	1 tanker spill (Arctic OCS production)
Prob. 1 + spills ≥ 1,000 bbl (GOM) ≥ 500 bbl (AK)	62 - 85%	86 – 99%	14 – 23%	81 - 94%	up to 98%	16 - 18%	-	-
Spills < 50 bbl Mean No. Spills	60 – 120	125 – 300	9 – 15	90 – 150	85 – 220	25 – 30	-	-
Prob. 1+ Spills**	**	**	**	**	**	**		
Spills 50 –999 bbl Mean No. Spills	5 – 9	10 – 23	1	7 – 12	7 – 17	2 – 3	-	-
Prob. 1+ Spills**	99 - **%	**	50 – 69%	**	**	85 - 90%		

* large spill sizes: pipeline: 4,600 bbl; platform: 1,500 bbl; tanker (GOM): 5,300 bbl; tanker (west coast): 7,800 bbl

** Estimated probability greater than 99.5%

OCS Spill Rates, Gulf of Mexico and offshore California spills, 1985-1999:

Spills 1.1-49.9 bbl: 88.46 spills per Bbbl 6.1 bbl average size 3.0 bbl median size
Spills 50-999 bbl: 6.72 spills per Bbbl 167.7 bbl average size 100.0 bbl median size

Estimates of the probability of one or more spills occurring using Alaska rates are based on spill rates calculated on 1985-1998 data of 500 bbl and greater from Alaska Onshore North Slope facilities and pipelines the Trans-Alaska Pipeline System. Using these rates as a proxy for spills >1,000 bbl is conservative, i.e., they should result in an overestimate of the number of spills of 1,000 barrels or greater since spill occurrence frequency varies inversely to spill size. Spill rates from ANS Crude tanker spills ≥ 1,000 bbl were also used for areas where the oil is assumed to be transported by tanker from Alaska to the U.S. west coast.

Table 4-2a. Slow the Pace of Leasing (Alternative 2) - Exploration and Development Scenario for the Gulf of Mexico Region

Scenario Elements	Gulf of Mexico Region		
	Western	Central	Eastern
Sales	5	5	1
Oil Production (BBO)	0.68 – 1.31	1.38 – 3.27	0.065 – 0.085
Gas production (Tcf)	4.05 – 7.20	7.95 – 16.50	0.265 – 0.340
Years of Activity	40	40	40
Platforms	50 – 75	130 – 240	1 – 2
Exploration and Delineation Wells	185 – 575	555 – 1,235	11 – 13
Development and Production Wells	490 - 825	890 – 1,760	19 – 27
Miles of Pipeline	500 – 1,500	800 – 2,400	150 – 200
Landfalls	up to 5	up to 5	1
Vessel Trips/Week	60 – 100	175 – 350	2 – 3
Helicopter Trips/Week	75 – 125	225 – 425	2 – 4
New Shore Bases	up to 3	0 – 1	0
New Process Facilities	0	0	0
New Waste Facilities	1	3	0
Drill Muds/well (bbl)			
Exploration/delineation	7,860	7,860	7,860
Development/production	5,800	5,800	5,800
Drill Cuttings/ well (bbl)			
Exploration/delineation	2,680	2,680	2,680
Development/production	1,630	1,630	1,630
Produced Water/well (bbl)			
Oil well	450	450	450
Gas well	68	68	68
Bottom Area Disturbed – Platforms (ha)	75 – 115	200 – 350	2 – 4
Bottom Area Disturbed – Pipeline (ha)	700 – 2,000	1,100 – 3,300	210 – 280
Platform Removals with Explosives	40 – 60	100 – 190	0

Table 4-2b. Slow the Pace of Leasing (Alternative 2) - Exploration and Development Scenario for the Alaska Region

Scenario Elements	Alaska Region				
	Beaufort Sea	Chukchi Sea	Hope Basin	Cook Inlet	Norton Basin
Sales	1 or 2*	1	1	1	1
Oil Production (BBO)	0.68 – 1.14	0.96 - 1.21	0.005 - 0.010 (condensate)	0.14 – 0.17	0.005 – 0.008 (condensate)
Gas production (Tcf)	None	None	0.145 – 0.357	0.19 – 0.29	0.260 – 0.400
Years of Activity	25	30	20	30	20
Platforms	4 – 8	2 - 4	1	1 – 3	1
Exploration and Delineation Wells	12 – 20	6 – 12	3 – 5	4 – 9	3 – 5
Development and Production Wells	130 – 220	106 - 160	4 – 9	42 – 54	7 – 10
Miles of Onshore Pipeline	60 – 120	330	0	75	0
Miles of Offshore Pipeline	125 – 200	100 - 160	20 – 70	25 – 75	25 – 55
Landfalls	2	1	1	1 – 2	1
Vessel Trips/Week	2 – 4	1 – 2	1	1 – 4	1
Helicopter Trips/Week	20 – 40	10 - 20	5	5 – 20	5
New Shore Bases	0	1	1	0	1
New Process Facilities	2	1	1	0	1
New Waste Facilities	0	1	1	0	1
Drill muds/well (bbl) Exploration/delineation Development/production	 255 290	 565 320	 350 200	 435 220	 565 380
Drill Cuttings/ well (bbl) Exploration/delineation Development/production	 1,520 2,550	 1,970 2,830	 940 1,520	 1,275 1,600	 1,970 3,335
Bottom Area Disturbed – Platforms (ha)	12 – 24	6 - 12	3	2 – 8	3
Bottom Area Disturbed – Pipelines (ha)	95 – 150	75 - 120	15 – 50	20 – 70	20 – 40
Platform Removals with Explosives	0	0	0	0	0

* Amount of oil and gas production and levels of activity in the Beaufort Sea assume 2 sales.

Table 4.2c. Slow the Pace of Leasing (Alternative 2) – Oil-Spill Assumptions

Scenario Elements	Gulf of Mexico Region: Western	Gulf of Mexico Region: Central	Gulf of Mexico Region: Eastern	Alaska Region: Beaufort Sea	Alaska Region: Chukchi Sea	Alaska Region: Cook Inlet	Alaska Region: Gulf of Alaska	Pacific Region
Oil Production (BBO)	0.68-1.31	1.38-3.27	0.065 – 0.085	0.68 – 1.14	0.96 – 1.21	0.14 – 0.17	0	0
Years of Activity	40	40	40	35	40	25	N/A	N/A
Large oil spills from OCS activity*	1 shallow platform spill 1 deep pipeline spill	1 shallow platform spill 1 shallow, 1 deep pipeline spills 1 deep tanker spill	1 shallow pipeline spill	1 pipeline spill	1 platform spill 1 pipeline spill in Chukchi	1 pipeline spill	1 tanker spill (Arctic OCS production)	1 tanker spill (Arctic OCS production)
Prob. 1 + spills ≥ 1,000 bbl (GOM) ≥ 500 bbl (AK)	62 - 85%	86 – 99%	10 – 12%	67 - 85%	79 – 86%	8 - 10%	-	-
Spills < 50 bbl Mean No. Spills	60 – 120	125 – 300	6 – 8	60 – 100	85 – 110	13 – 15	-	-
Prob. 1+ Spills**	**	**	**	**	**	**		
Spills 50 –999 bbl Mean No. Spills	5 – 9	10 – 23	1	5 - 8	7 – 8	1	-	-
Prob. 1+ Spills**	99 - **%	**	50 – 69%	**	**	62 - 69%		

* large spill sizes: pipeline: 4,600 bbl; platform: 1,500 bbl; tanker (GOM): 5,300 bbl; tanker (west coast): 7,800 bbl

** Estimated probability greater than 99.5%

OCS Spill Rates, Gulf of Mexico and offshore California spills, 1985-1999:

Spills 1.1-49.9 bbl: 88.46 spills per Bbbl 6.1 bbl average size 3.0 bbl median size
Spills 50-999 bbl: 6.72 spills per Bbbl 167.7 bbl average size 100.0 bbl median size

Estimates of the probability of one or more spills occurring using Alaska rates are based on spill rates calculated on 1985-1998 data of 500 bbl and greater from Alaska Onshore North Slope facilities and pipelines the Trans-Alaska Pipeline System. Using these rates as a proxy for spills >1,000 bbl is conservative, i.e., they should result in an overestimate of the number of spills of 1,000 barrels or greater since spill occurrence frequency varies inversely to spill size. Spill rates from ANS Crude tanker spills ≥ 1,000 bbl were also used for areas where the oil is assumed to be transported by tanker from Alaska to the U.S. west coast.

Table 4-3a. Exclude Some Planning Areas (Alternative 3) - Exploration and Development Scenario for the Gulf of Mexico Region

Scenario Elements	Gulf of Mexico Region		
	Western	Central	Eastern
Sales	5	5	None
Oil Production (BBO)	0.68 – 1.31	1.38 – 3.27	None
Gas production (Tcf)	4.05 – 7.20	7.95 – 16.50	None
Years of Activity	40	40	-
Platforms	50 – 75	130 – 240	-
Exploration and Delineation Wells	185 – 575	555 – 1,235	-
Development and Production Wells	490 - 825	890 – 1,760	-
Miles of Pipeline	500 – 1,500	800 – 2,400	-
Landfalls	0 - 5	0 – 5	-
Vessel Trips/Week	60 – 100	175 – 350	-
Helicopter Trips/Week	75 – 125	225 – 425	-
New Shore Bases	0 - 3	0 – 1	-
New Process Facilities	0	0	-
New Waste Facilities	2	4	-
Drill Muds/well (bbl)			-
Exploration/delineation	7,860	7,860	
Development/production	5,800	5,800	
Drill Cuttings/ well (bbl)			-
Exploration/delineation	2,680	2,680	
Development/production	1,630	1,630	
Produced Water/well (bbl)			-
Oil well	450	450	
Gas well	68	68	
Bottom Area Disturbed – Platforms (ha)	75 – 115	200 – 350	-
Bottom Area Disturbed – Pipeline (ha)	700 – 2,000	1,100 – 3,300	-
Platform Removals with Explosives	40 – 60	100 – 190	-

Table 4-3b. Exclude Some Planning Areas (Alternative 3) - Exploration and Development Scenario for the Alaska Region

Scenario Elements	Alaska Region				
	Beaufort Sea	Chukchi Sea	Hope Basin	Cook Inlet	Norton Basin
Sales	3	2	None	2	None
Oil Production (BBO)	1.02 – 1.71	0.96 - 2.42	None	0.28 – 0.34	None
Gas production (Tcf)	None	None	None	0.38 – 0.58	None
Years of Activity	30	35	-	35	-
Platforms	6 – 12	2 - 8	-	2 – 6	-
Exploration and Delineation Wells	18 – 30	6 – 24	-	8 – 18	-
Development and Production Wells	190 – 325	106 - 320	-	84 – 108	-
Miles of Onshore Pipeline	60 – 120	330	-	75	-
Miles of Offshore Pipeline	125 - 160	100 - 260	-	40 – 125	-
Landfalls	2	1	-	2 – 4	-
Vessel Trips/Week	3 – 6	1 - 4	-	2 – 8	-
Helicopter Trips/Week	30 – 60	10 - 40	-	10 – 40	-
New Shore Bases	0	1	-	0	-
New Process Facilities	2	1	-	0	-
New Waste Facilities	0	1	-	0	-
Drill muds/well (bbl)			-		-
Exploration/delineation	255	565		435	
Development/production	290	320		220	
Drill Cuttings/ well (bbl)			-		-
Exploration/delineation	1,520	1,970		1,275	
Development/production	2,550	2,830		1,600	
Bottom Area Disturbed – Platforms (ha)	18 – 36	6 - 24	-	4 – 12	-
Bottom Area Disturbed – Pipelines (ha)	95 - 120	75 - 195	-	30 - 95	-
Platform Removals with Explosives	0	0	-	0	-

Assumptions

- All cuttings from exploration and delineation wells will be discharged at the offshore well site.
- All cuttings from production and development wells will be disposed of subsurface.
- 80% of drilling muds will be recycled.
- 20% of drilling muds for exploration and delineation wells will be discharged at the well site.
- All spent drilling muds for production and development wells will be disposed of subsurface or at onshore waste disposal sites.
- All produced water will be reinjected.

Table 4.3c. Exclude Some Planning Areas (Alternative 3) – Oil-Spill Assumptions

Scenario Elements	Gulf of Mexico Region: Western	Gulf of Mexico Region: Central	Gulf of Mexico Region: Eastern	Alaska Region: Beaufort Sea	Alaska Region: Chukchi Sea	Alaska Region: Cook Inlet	Alaska Region: Gulf of Alaska	Pacific Region
Oil Production (BBO)	0.68-1.31	1.38-3.27	None	1.02-1.71	0.96- 2.42	0.28-0.34	0	0
Years of Activity	40	40	40	35	40	25	N/A	N/A
Large oil spills from OCS activity*	1 shallow platform spill 1 deep pipeline spill	1 shallow platform spill 1 shallow, 1 deep pipeline spills 1 deep tanker spill	--	1 platform spill 1 pipeline spill	1 platform spill 2 pipeline spills in Chukchi	1 pipeline spill	1 tanker spill (Arctic OCS production)	1 tanker spill (Arctic OCS production)
Prob. 1 + spills $\geq$ 1,000 bbl (GOM) $\geq$ 500 bbl (AK)	62 - 85%	86 – 99%		81 - 94%	up to 98%	16 - 18%	-	-
Spills < 50 bbl Mean No. Spills Prob. 1+ Spills**	60 – 120 **	125 – 300 **	--	90 – 150 **	85 – 220 **	25 – 30 **	-	-
Spills 50 –999 bbl Mean No. Spills Prob. 1+ Spills**	5 – 9 99 - **%	10 – 23 **	--	7 – 12 **	7 – 17 **	2 – 3 85 - 90%	-	-

* large spill sizes: pipeline: 4,600 bbl; platform: 1,500 bbl; tanker (GOM): 5,300 bbl; tanker (west coast): 7,800 bbl

** Estimated probability greater than 99.5%

OCS Spill Rates, Gulf of Mexico and offshore California spills, 1985-1999:

Spills 1.1-49.9 bbl: 88.46 spills per Bbbl 6.1 bbl average size 3.0 bbl median size
Spills 50-999 bbl: 6.72 spills per Bbbl 167.7 bbl average size 100.0 bbl median size

Estimates of the probability of one or more spills occurring using Alaska rates are based on spill rates calculated on 1985-1998 data of 500 bbl and greater from Alaska Onshore North Slope facilities and pipelines the Trans-Alaska Pipeline System. Using these rates as a proxy for spills >1,000 bbl is conservative, i.e., they should result in an overestimate of the number of spills of 1,000 barrels or greater since spill occurrence frequency varies inversely to spill size. Spill rates from ANS Crude tanker spills $\geq$ 1,000 bbl were also used for areas where the oil is assumed to be transported by tanker from Alaska to the U.S. west coast.

Table 4-4a. Accelerated Leasing (Alternative 4) - Exploration and Development Scenario for the Gulf of Mexico Region

Scenario Elements	Gulf of Mexico Region		
	Western	Central	Eastern
Sales	5	5	3
Oil Production (BBO)	0.68 – 1.31	1.38 – 3.27	0.124 – 0.255
Gas production (Tcf)	4.05 – 7.20	7.95 – 16.50	0.495 – 1.02
Years of Activity	40	40	45
Platforms	50 – 75	130 – 240	3 – 5
Exploration and Delineation Wells	185 – 575	555 – 1,235	21 – 39
Development and Production Wells	490 - 825	890 – 1,760	38 – 78
Miles of Pipeline	500 – 1,500	800 – 2,400	250 – 400
Landfalls	up to 5	up to 5	1 - 3 (gas only)
Vessel Trips/Week	60 – 100	175 – 350	5 – 8
Helicopter Trips/Week	75 – 125	225 – 425	6 – 10
New Shore Bases	up to 3	0 – 1	0
New Process Facilities	0	0	0
New Waste Facilities	1	3	0
Drill Muds/well (bbl)			
Exploration/delineation	7,860	7,860	7,860
Development/production	5,800	5,800	5,800
Drill Cuttings/ well (bbl)			
Exploration/delineation	2,680	2,680	2,680
Development/production	1,630	1,630	1,630
Produced Water/well (bbl)			
Oil well	450	450	450
Gas well	68	68	68
Bottom Area Disturbed – Platforms (ha)	75 – 115	200 – 350	6 – 10
Bottom Area Disturbed – Pipeline (ha)	700 – 2,000	1,100 – 3,300	350 – 560
Platform Removals with Explosives	40 – 60	100 – 190	0

Table 4-4b. Accelerated Leasing (Alternative 4) - Exploration and Development Scenario for the Alaska Region

Scenario Elements	Alaska Region				
	Beaufort Sea	Chukchi Sea	Hope Basin	Cook Inlet	Norton Basin
Sales	5	2	2	2	1
Oil Production (BBO)	1.70 – 2.85	0.96 - 2.42	0.010 – 0.020 (condensate)	0.28 – 0.34	0.005 – 0.008 (condensate)
Gas production (Tcf)	None	None	0.290 – 0.714	0.38 – 0.58	0.260 – 0.400
Years of Activity	35	35	25	35	20
Platforms	10 – 20	2 - 8	2	2 – 6	1
Exploration and Delineation Wells	30 – 50	6 – 24	6 – 10	8 – 18	3 – 5
Development and Production Wells	320 – 545	106 - 320	8 – 18	84 – 108	7 – 10
Miles of Onshore Pipeline	75 – 130	330	0	75	0
Miles of Offshore Pipeline	140 – 180	100 - 260	50 – 100	40 – 125	25 – 55
Landfalls	2 – 3	1	1	2 – 4	1
Vessel Trips/Week	5 – 10	1 - 4	1	2 – 8	1
Helicopter Trips/Week	50 – 100	10 - 40	10	10 – 40	5
New Shore Bases	0	1	1	0	1
New Process Facilities	2 – 3	1	1	0	1
New Waste Facilities	0	1	1	0	1
Drill Muds/Well (bbl)					
Exploration/Delineation	255	565	350	435	565
Development/Production	290	320	200	220	380
Drill Cuttings/Well (bbl)					
Exploration/Delineation	1,520	1,970	940	1,275	1,970
Development/Production	2,550	2,830	1,520	1,600	3,335
Bottom Area Disturbed – Platforms (ha)	30 - 60	6 - 24	6	4 – 12	3
Bottom Area Disturbed – Pipelines (ha)	100 - 135	75 - 195	40 - 75	30 - 95	20 – 40
Platform Removals with Explosives	0	0	0	0	0

Assumptions
- All cuttings from exploration and delineation wells will be discharged at the offshore well site.
- All cuttings from production and development wells will be disposed of subsurface.
- 80% of drilling muds will be recycled.
- 20% of drilling muds for exploration and delineation wells will be discharged at the well site.
- All spent drilling muds for production and development wells will be disposed of subsurface or at onshore waste disposal sites.
- All produced water will be reinjected.

Table 4.4c. Accelerated Leasing (Alternative 4) – Oil Spill Assumptions

Scenario Elements	Gulf of Mexico Region: Western	Gulf of Mexico Region: Central	Gulf of Mexico Region: Eastern	Alaska Region: Beaufort Sea	Alaska Region: Chukchi Sea	Alaska Region: Cook Inlet	Alaska Region: Gulf of Alaska	Pacific Region
Oil Production (BBO)	0.68-1.31	1.38-3.27	0.124 – 0.255	1.70 – 2.85	0.96- 2.42	0.28-0.34	0	0
Years of Activity	40	40	40	35	40	25	N/A	N/A
Large oil spills from OCS activity*	1 shallow platform spill 1 deep pipeline spill	1 shallow platform spill 1 shallow, 1 deep pipeline spills 1 deep tanker spill	1 shallow pipeline spill	1 platform spill 2 pipeline spills	1 platform spill 2 pipeline spills in Chukchi	1 pipeline spill	1 tanker spill (Arctic OCS production)	1 tanker spill (Arctic OCS production)
Prob. 1 + spills ≥ 1,000 bbl (GOM) ≥ 500 bbl (AK)	62 - 85%	86 – 99%	17 - 32%	94 – 99%	up to 98%	16 - 18%	-	-
Spills < 50 bbl Mean No. Spills	60 – 120	125 – 300	11 – 23	155 – 260	85 – 220	25 – 30	-	-
Prob. 1+ Spills**	**	**	**	**	**	**		
Spills 50 –999 bbl Mean No. Spills	5 – 9	10 – 23	1 – 2	12 – 20	7 – 17	2 – 3	-	-
Prob. 1+ Spills**	99 - **%	**	57 – 83%	**	**	85 - 90%		

* large spill sizes: pipeline: 4,600 bbl; platform: 1,500 bbl; tanker (GOM): 5,300 bbl; tanker (west coast): 7,800 bbl

** Estimated probability greater than 99.5%

OCS Spill Rates, Gulf of Mexico and offshore California spills, 1985-1999:

Spills 1.1-49.9 bbl: 88.46 spills per Bbbl 6.1 bbl average size 3.0 bbl median size
Spills 50-999 bbl: 6.72 spills per Bbbl 167.7 bbl average size 100.0 bbl median size

Estimates of the probability of one or more spills occurring using Alaska rates are based on spill rates calculated on 1985-1998 data of 500 bbl and greater from Alaska Onshore North Slope facilities and pipelines the Trans-Alaska Pipeline System. Using these rates as a proxy for spills >1,000 bbl is conservative, i.e., they should result in an overestimate of the number of spills of 1,000 barrels or greater since spill occurrence frequency varies inversely to spill size. Spill rates from ANS Crude tanker spills ≥ 1,000 bbl were also used for areas where the oil is assumed to be transported by tanker from Alaska to the U.S. west coast.

Table 4-5a. Oil Consumption by End-Use Sector

End-Use Sector	Transportation	Industrial	Residential and Commercial	Electricity Generation	Total
1999 Consumption (Quadrillion Btu)	25.4	9.6	2.1	.9	38.0
The Sector as a Percentage of Total 1999 Oil Consumption	66.9%	25.2%	5.5%	2.5%	100.0%
Oil as a Percentage of the Sector (1999)	96.9%	26.8%	5.9%	2.3%	39.1%

Source: U.S. Department of Energy, Energy Information Administration (2001).

Table 4-5b. Natural Gas Consumption by End-Use Sector

End-Use Sector	Industrial	Residential and Commercial	Electricity Generation	Transpor-tation	Total
1999 Consumption (Quadrillion Btu)	10.4	8.0	3.2	.8	22.3
Sector As a Percentage of Total 1999 Gas Consumption	46.5%	35.8%	14.2%	3.4%	100.0%
Gas As a Percentage of the Sector (1999)	29.1%	22.8%	8.9%	2.9%	23.0%

Source: U.S. Department of Energy, Energy Information Administration (2001).

Table 4-5c. Most Likely Response to the No Action (Alternative 5)

Sector	% of OCS Production		Quantity Involved	
	Low	High	Low	High
Oil				
OCS Production (BBO)	-100%	-100%	-3.1	-9.2
Onshore Production (BBO)	3%	3%	0.1	0.2
Imports (BBO)	86%	88%	2.7	8.1
Conservation (BBOE)	7%	6%	0.2	0.5
Switch to Gas (BBOE)	5%	4%	0.2	0.4
Gas				
OCS Production (TCFG)	-100%	-100%	-9.3	-17.7
Onshore Production (TCFG)	26%	28%	2.4	4.9
Imports (TCFG)	16%	16%	1.4	2.8
Conservation (TCFGE)	17%	16%	1.6	2.9
Switch to Oil (TCFGE/BBOE)	42%	40%	3.8/0.7	7.1/1.3
Induced Oil Imports (BBO)	NA	NA	0.6	1.1

BBO = billion barrels of oil
BBOE = the Btu equivalent of billion barrels of oil
TCFG = trillion cubic feet of natural gas
TCFGE = the Btu equivalent of trillion cubic feet of natural gas

Table 4-5d. No Action (Alternative 5) – Oil-Spill Assumptions

Variables	Gulf of Mexico	Alaska	Pacific
Additional Imports (BBO)	0.72 - 2.36	0.12 - 0.22[1]	2.04 - 4.50
# of spills ≥ 1000 bbl[2]	0.44 - 1.43	0.07 - 0.13	1.23 - 2.72
Probability of 1 or more spills ≥ 1000 bbl	36% - 76%	7% - 12%	71% - 93%
Imports Induced by Switching from Gas to Oil (BBO)[3]	0.57 - 1.70	-	-
# of spills ≥ 1000 bbl	0.34 - 1.03	-	-
Probability of 1 or more spills ≥ 1000 bbl	29% - 64%	-	-
Total Imports (BBO)	1.29 - 4.06	0.12 - 0.22	2.04 - 4.50
# of spills ≥ 1000 bbl	0.78 - 2.46	0.07 - 0.13	1.23 - 2.72
Probability of 1 or more spills ≥ 1000 bbl	54% - 91%	7% - 12%	71% - 93%

[1]The oil replacing anticipated OCS production in Alaska would not be imported. It would be Alaska North Slope oil tankered from Valdez to the refinery at Nikiski. Furthermore, on April 28, 1996 President Clinton signed an order permitting the export of Alaska North Slope oil. Because this oil is required to remain at least 200 miles from the coast, it is not expected to have any negative environmental impacts outside the Prince William Sound area. The no action alternative can be expected to diminish the oil available for export; however, this reduction in exports is not expected to make any significant change in oil spills or their environmental impacts.

[2]The import spills were estimated using half of the 0.72 spill/BBO rate for tankers in U.S. waters (based on 1985-1999 spill data). Spills associated with the first half of the import tanker trips are assumed to occur outside U.S. waters.

[3]Energy markets will respond to the loss of OCS natural gas production under the no action alternative by switching to an array of energy alternatives. The MMS MarketSim2000 model estimates that on an energy equivalent basis 40 to 42 percent of the lost gas will be replaced by switching to oil. According to the model, about 86 percent of the additional oil demand will consist of additional oil imports. Additional imports will lead to potential additional oil spills. The spills listed in this section are those spills resulting from switching from natural gas to oil under the no action alternative.

Table 4-6a. Cumulative Case - Exploration and Development Scenario for the Gulf of Mexico Region

Scenario Elements	Gulf of Mexico Region		
	Western	Central	Eastern
Oil Production (BBO)	3.35 – 5.53	12.01 – 16.53	0.139 – 0.37
Gas Production (Tcf)	42.66 – 58.17	108.27 – 146.27	1.406 – 2.456
Years of Activity	60	60	50
Platforms	620 – 855	2,360 – 3,130	4 – 7
Exploration and Delineation Wells	1,840 – 2,670	7,110 – 8,580	38 – 73
Development and Production Wells	4,510 – 5,860	12,550 – 15,050	60 – 136
Miles of Pipeline	1,500 – 4,500	2,400 – 7,200	350 – 500
Landfalls	0 – 5	0 – 5	2 – 4 (gas only)
Vessel Trips/Week	930 – 1,280	3,540 – 4700	6 – 11
Helicopter Trips/Week	1,240 – 1,700	4,700 – 6,250	8 – 14
New Shore Bases	0 – 3	0 - 1	1
New Process Facilities	0 – 1	0 – 1	1
New Waste Facilities	4	9	1
Drill Muds/Well (bbl)			
Exploration/Delineation	7,860	7,860	7,860
Development/Production	5,800	5,800	5,800
Drill Cuttings/ Well (bbl)			
Exploration/Delineation	2,680	2,680	2,680
Development/Production	1,630	1,630	1,630
Produced Water/Well (bbl)			
Oil Well	450	450	450
Gas Well	68	68	68
Bottom Area Disturbed – Platforms (ha)	500 – 680	1,890 – 2,500	8 – 14
Bottom Area Disturbed – Pipeline (ha)	2,100 – 6,300	3,360 – 10,000	490 – 700
Platform Removals with Explosives	500 - 680	1,890 – 2,500	1 – 2

Table 4-6b. Cumulative Case - Exploration and Development Scenario for the Alaska Region

Scenario Elements	Alaska Region				
	Beaufort Sea	Chukchi Sea	Hope Basin	Cook Inlet	Norton Basin
Oil Production (BBO)	1.89 – 3.22	0.96 - 2.42	0.010 – 0.020 (condensate)	0.42 – 0.50	0.005 – 0.008 (condensate)
Gas production (Tcf)	None	None	0.290 – 0.714	0.56 – 0.86	0.260 – 0.400
Years of Activity	40	35	25	35	20
Platforms	15 – 25	2 - 8	2	4 – 10	1
Exploration and Delineation Wells	40 - 60	6 – 24	6 – 10	12 – 30	3 – 5
Development and Production Wells	350 – 600	106 - 320	8 – 18	130 – 160	7 – 10
Miles of Onshore Pipeline	85 - 140	330	0	75	0
Miles of Offshore Pipeline	160 – 215	100 - 260	50 – 100	70 – 225	25 – 55
Landfalls	2 – 4	1	1	2 - 4	1
Vessel Trips/Week	8 – 13	1 - 4	1	4 – 10	1
Helicopter Trips/Week	75 – 125	10 - 40	10	20 – 50	5
New Shore Bases	0	1	1	0	1
New Process Facilities	3 – 4	1	1	0	1
New Waste Facilities	0	1	1	0	1
Drill Muds/Well (bbl)					
Exploration/Delineation	255	565	350	435	565
Development/Production	290	320	200	220	380
Drill Cuttings/Well (bbl)					
Exploration/Delineation	1,520	1,970	940	1,275	1,970
Development/Production	2,550	2,830	1,520	1,600	3,335
Bottom Area Disturbed – Platforms (ha)	45 - 75	6 - 24	6	8 – 20	3
Bottom Area Disturbed – Pipelines (ha)	120 - 160	75 - 195	40 - 75	52 - 170	20 – 40
Platform Removals with Explosives	0	0	0	0	0

Assumptions

- All cuttings from exploration and delineation wells will be discharged at the offshore well site.
- All cuttings from production and development wells will be disposed of subsurface.
- 80% of drilling muds will be recycled.
- 20% of drilling muds for exploration and delineation wells will be discharged at the well site.
- All spent drill muds for production and development wells will be disposed of subsurface or at onshore waste disposal sites.
- All produced water will be reinjected.

Table 4-6c. Cumulative Case – Oil-Spill Assumptions

Scenario Elements	Gulf of Mexico Region			Alaska Region				Pacific Region
	Western	Central	Eastern	Beaufort Sea	Chukchi Sea	Cook Inlet	Gulf of Alaska	
Oil Production (BBO)	3.35-5.53	12.01-16.53	0.139 – 0.37	1.89-3.22	0.96-2.42	0.42-0.50	0	N/A
Years of Activity	60	60	50	40	35	35	N/A	N/A
Large oil spills from OCS activity*	1 shallow platform spill 3 shallow, 1 deep pipeline spills 1 deep, 1 shallow tanker spill	1 shallow, 1 deep platform spills 7 shallow, 6 deep pipeline spills 3 shallow, 3 deep tanker spills	1 shallow pipeline spill	1 platform spill 2 pipeline spills	1 platform spill 2 pipeline spills	1 pipeline spill	1 tanker spill (Arctic OCS production)	2 tanker spills (Arctic OCS production) 1 pipeline spill (So. Calif. OCS production)
Prob. 1 + spills $\geq$ 1,000 bbl (GOM) $\geq$ 500 bbl (AK)	**	**	19 – 43%	95-99%	up to 98%	22-26%	-	-
Large tanker spills from AK and North Slope oil production	0	0	0	0	0	0	3	3
Large oil spills from import tankers*	15	20	12	0	0	0	0	5
Spills < 50 bbl Mean No. Spills Prob. 1+ Spills**	300 – 500 **	1,100 – 1,500 **	13 – 34 **	170 – 290 **	85 – 220 **	38 – 45 **	-	-
Spills 50 –999 bbl Mean No. Spills Prob. 1+ Spills**	23 – 38 **	80 – 115 **	1 – 3 75-86%	13 – 22 **	7 – 17 **	3 – 4 94-97%	-	-

* large spill sizes: pipeline: 4,600 bbl; platform: 1,500 bbl; tanker (GOM): 5,300 bbl; tanker (west coast): 7,800 bbl

** Estimated probability greater than 99.5%

OCS Spill Rates, Gulf of Mexico and offshore California spills, 1985-1999:

Spills 1.1-49.9 bbl: 88.46 spills per Bbbl 6.1 bbl average size 3.0 bbl median size
Spills 50-999 bbl: 6.72 spills per Bbbl 167.7 bbl average size 100.0 bbl median size

Estimates of the probability of one or more spills occurring using Alaska rates are based on spill rates calculated on 1985-1998 data of 500 bbl and greater from Alaska Onshore North Slope facilities and pipelines the Trans-Alaska Pipeline System. Using these rates as a proxy for spills >1,000 bbl is conservative, i.e., they should result in an overestimate of the number of spills of 1,000 barrels or greater since spill occurrence frequency varies inversely to spill size. Spill rates from ANS Crude tanker spills $\geq$ 1,000 bbl were also used for areas where the oil is assumed to be transported by tanker from Alaska to the U.S. west coast.

Table 4-7a. Estimated Greenhouse Gas Emission Rate From Proposed 2002-2007 OCS Program Activities (thousand metric tons of carbon equivalent per year).

Area of Activity	CO_2	CH_4
Gulf of Mexico	90 - 161	29 – 48
Alaska	204 - 456	0.6 - 1.3
Tanker Transportation to West Coast	46 - 105	63 – 144
Total OCS Activities	340 - 722	93 - 193

Table 4-7b. Estimated Greenhouse Gas Emission Rate From OCS Cumulative Program Activities (thousand metric tons of carbon equivalent per year).

Area of Activity	CO_2	CH_4
Gulf of Mexico	386 - 567	144 – 191
Alaska	381 - 723	1.1 - 2.1
Tanker Transportation to West Coast	75 - 134	103 – 184
Pacific	36	10
Total OCS Activities	879 - 1,461	258 - 387

Table 4-8a. Estimated Peak-Year Emissions for the Proposed 2002-2007 OCS Program, Western Gulf of Mexico Planning Area

Activity	Pollutant (tons/yr)				
	NO_x	SO_2	PM_{10}	CO	VOC
Service Vessels	323-516	66-105	37-59	63-102	28-44
Pipeline Vessels	221-735	31-102	9-30	74-246	20-67
Helicopters	3-6	0.7-1	0.8-1	8-14	0.6-1
Tanker and Barge Fugitives	0	0	0	0	219-430
Tanker and Barge Exhaust	45-88	22-44	7-14	5-9	1-2
Platform Construction	632-1,053	36-60	8-14	125-208	37-62
Exploration Wells	258-773	30-90	7-22	69-206	25-74
Production Wells	666-946	78-111	19-27	178-252	64-91
Production Platforms	3,572-6,513	600-1094	65-119	831-1,516	2,708-4,938
Total	5,719-10,629	864-1,608	154-287	1,352-2,552	3,103-5,710

Table 4-8b. Estimated Peak-Year Emissions for the Proposed 2002-2007 OCS Program, Central Gulf of Mexico Planning Area

Activity	Pollutant (tons/yr)				
	NO_x	SO_2	PM_{10}	CO	VOC
Service Vessels	544-904	111-184	62-103	107-178	47-77
Pipeline Vessels	272-882	38-123	11-36	91-296	25-81
Helicopters	11-18	2-4	2-4	25-44	2-3
Tanker and Barge Fugitives	0	0	0	0	469-1,023
Tanker and Barge Exhaust	96-208	48-105	15-33	10-22	3-6
Platform Construction	1,264-2,528	72-144	17-34	250-499	74-124
Exploration Wells	634-1,368	74-160	18-39	169-364	61-132
Production Wells	1,139-2,170	134-254	32-62	304-579	110-209
Production Platforms	7,266-14,328	1,221-2,408	133-262	1,691-3,334	5,509-10,864
Total	11,224-22,407	1,700-1,495	291-574	2,646-5,315	6,299-12,519

Table 4-8c. Estimated Peak-Year Emissions for the Proposed 2002-2007 OCS Program, Eastern Gulf of Mexico Planning Area

Activity	Pollutant (tons/yr)				
	NO_x	SO_2	PM_{10}	CO	VOC
Service Vessels	30-42	6-9	3-5	6-8	3-4
Pipeline Vessels	735-858	102-120	30-36	246-288	67-78
Helicopters	0.2-0.3	0.0-0.1	0.0-0.1	0.4-0.6	0.0
Tanker and Barge Fugitives	0	0	0	0	0
Tanker and Barge Exhaust	0	0	0	0	0
Platform Construction	211	12	3	42	12
Exploration Wells	40	5	1	11	4
Production Wells	86-129	10-15	2-4	23-34	8-12
Production Platforms	366-626	62-105	7-11	85-146	278-474
Total	1,468-1,907	197-265	47-60	413-529	372-585

Table 4-8d. Estimated Typical Emissions for Activities Under the Proposed 2002-2007 OCS Program, Alaska Region

Activity	Pollutant (tons)				
	NO_x	SO_2	PM_{10}	CO	VOC
Exploration Drilling[1] – Floating Drilling Vessel in Arctic	2,312	83	75	264	120
Exploration Drilling[1] – Bottom-Founded Vessel in Arctic	1,101	54	54	257	60
Ice Island Construction in Arctic[2]	821	66	58	184	64
Platform Installation in Open Water[2]	176	12	12	42	12
Pipeline Construction[3]	9.3	0.8	0.7	2.1	0.7
Production Well Drilling[4]	36	2.2	0.3	5.9	0.3
Production Facility[5]	268	11	15	184	89

[1] Exploration drilling emissions are in terms of tons/well.
[2] Construction and installation emissions are in terms of tons/facility.
[3] Pipeline installation emissions are in terms of tons/mile.
[4] Production well drilling is in terms of tons/well.
[5] Production facility emissions are in terms of tons/year/facility.

Table 4-9. Gulf of Mexico Proposed Action Population, Labor, and Income Projections

Region	Year				
	2000	2005	2010	2015	2020
Eastern Planning Area					
All-Industry Total	4,823,290	5,221,000	5,515,000	5,674,000	5,743,000
Oil and Gas	5,720	6,000	5,600	5,500	5,100
Low Additional Jobs	0	500	400	300	300
High Additional Jobs	0	1,500	1,700	1,700	1,700
Low Additional Income (Millions 1987 Dollars)	0	18	16	12	12
High Additional Income (Millions 1987 Dollars)	0	56	64	64	64
Low Additional Population	0	900	800	600	600
High Additional Population	0	2,800	3,200	3,200	3,200
% Low Additional Jobs	0%	0.01%	0.01%	0.01%	0.01%
% High Additional Jobs	0%	0.03%	0.03%	0.03%	0.03%
Central Planning Area					
All-Industry Total	2,352,510	2,447,000	2,521,000	2,556,000	2,573,000
Oil and Gas	48,410	45,000	43,000	40,000	37,000
Low Additional Jobs	0	7,300	8,700	8,700	8,700
High Additional Jobs	0	20,200	24,300	24,300	24,200
Low Additional Income (Millions 1987 Dollars)	0	279	334	334	334
High Additional Income (Millions 1987 Dollars)	0	770	929	928	924
Low Additional Population	0	13,800	16,500	16,500	16,500
High Additional Population	0	38,100	46,000	46,000	45,700
% Low Additional Jobs	0%	0.30%	0.35%	0.34%	0.34%
% High Additional Jobs	0%	0.82%	0.96%	0.95%	0.94%
Western Planning Area					
All-Industry Total	3,707,580	4,012,000	4,288,000	4,499,000	4,696,000
Oil and Gas	86,070	82,500	80,000	77,000	71,000
Low Additional Jobs	0	2,100	2,500	2,500	2,500
High Additional Jobs	0	7,400	8,700	8,700	7,800
Low Additional Income (Millions 1987 Dollars)	0	80	96	95	96
High Additional Income (Millions 1987 Dollars)	0	290	333	333	296
Low Additional Population	0	4,000	4,700	4,700	4,700
High Additional Population	0	13,900	16,500	16,500	14,700
% Low Additional Jobs	0%	0.05%	0.06%	0.06%	0.05%
% High Additional Jobs	0%	0.18%	0.20%	0.19%	0.17%
Gulf of Mexico Coastal Areas					
All-Industry Total	10,883,380	11,680,000	12,324,000	12,729,000	13,012,000
Oil and Gas	140,200	133,000	128,000	123,000	113,000
Low Additional Jobs	0	9,900	11,700	11,600	11,600
High Additional Jobs	0	28,900	34,700	34,700	33,600
Low Additional Income (Millions 1987 Dollars)	0	377	446	442	442
High Additional Income (Millions 1987 Dollars)	0	1,107	1,335	1,335	1,293
Low Additional Population	0	18,700	22,100	21,800	21,800
High Additional Population	0	54,800	65,600	65,600	63,500
% Low Additional Jobs	0%	0.08%	0.09%	0.09%	0.09%
% High Additional Jobs	0%	0.25%	0.28%	0.27%	0.26%

Table 4-10. Gulf of Mexico Proposed Action Sensitive Industry Projections

	2000	2005	2010	2015	2020	% Change to 2020	Proportion of Change
Coastal Labor Markets							
All-Industry Total	10,883,000	11,682,000	12,324,000	12,729,000	13,012,000	20%	100%
Ag Services, Forestry, Fisheries	184,000	206,000	224,000	235,000	246,000	33%	3%
Coastal Tourism/Travel	1,653,000	1,772,000	1,868,000	1,929,000	1,972,000	19%	15%
Impact Sensitive Employment	1,837,000	1,978,000	2,092,000	2,165,000	2,218,000	21%	18%
Percent Impact Sensitive	17%	17%	17%	17%	17%		
Western Planning Area							
All-Industry Total	3,708,000	4,012,000	4,288,000	4,499,000	4,696,000	27%	100%
Ag Services, Forestry, Fisheries	54,000	62,000	69,000	74,000	79,000	46%	3%
Coastal Tourism/Travel	582,000	628,000	671,000	703,000	733,000	26%	15%
Impact Sensitive Employment	636,000	690,000	740,000	777,000	813,000	28%	18%
Percent Impact Sensitive	17%	17%	17%	17%	17%		
Central Planning Area							
All-Industry Total	2,353,000	2,448,000	2,521,000	2,556,000	2,573,000	9%	100%
Ag Services, Forestry, Fisheries	39,000	42,000	45,000	46,000	48,000	25%	4%
Coastal Tourism/Travel	380,000	396,000	408,000	414,000	417,000	10%	16%
Impact Sensitive Employment	419,000	438,000	453,000	460,000	465,000	11%	21%
Percent Impact Sensitive	18%	18%	18%	18%	18%		
Eastern Planning Area							
All-Industry Total	4,823,000	5,221,000	5,515,000	5,674,000	5,743,000	19%	100%
Ag Services, Forestry, Fisheries	92,000	103,000	110,000	115,000	118,000	29%	3%
Coastal Tourism/Travel	690,600	748,000	790,000	813,000	822,000	19%	14%
Impact Sensitive Employment	782,000	850,000	900,000	928,000	941,000	20%	17%
Percent Impact Sensitive	16%	16%	16%	16%	16%		
Mobile							
All-Industry Total	319,000	339,000	355,000	363,000	367,000	15%	100%
Ag Services, Forestry, Fisheries	8,000	8,000	9,000	9,000	10,000	22%	4%
Coastal Tourism/Travel	52,0001	56,000	58,000	60,000	60,000	15%	16%
Impact Sensitive Employment	60,000	64,000	67,000	69,000	70,000	16%	20%
Percent Impact Sensitive	19%	19%	19%	19%	19%		

Table 4-10. Gulf of Mexico Proposed Action Sensitive Industry Projections (continued)

	2000	2005	2010	2015	2020	% Change to 2020	Proportion of Change
Biloxi-Gulfport							
All-Industry Total	256,000	276,000	292,000	302,000	307,000	0%	100%
Ag Services, Forestry, Fisheries	10,000	11,000	12,000	12,000	13,000	27%	7%
Coastal Tourism/Travel	39,000	42,000	45,000	46,000	47,000	20%	21%
Impact Sensitive Employment	49,000	53,000	56,000	58,000	60,000	21%	28%
Percent Impact Sensitive	19%	19%	19%	19%	19%		
New Orleans							
All-Industry Total	736,000	755,000	768,000	773,000	774,000	5%	100%
Ag Services, Forestry, Fisheries	10,000	11,000	12,000	12,000	13,000	27%	7%
Coastal Tourism/Travel	97,000	100,000	101,000	102,000	102,000	5%	13%
Impact Sensitive Employment	107,000	111,000	113,000	114,000	115,000	7%	20%
Percent Impact Sensitive	15%	15%	15%	15%	15%		
Baton Rouge							
All-Industry Total	432,000	449,000	464,000	471,000	475,000	10%	100%
Ag Services, Forestry, Fisheries	3,000	4,000	4,000	4,000	4,000	32%	3%
Coastal Tourism/Travel	78,000	82,000	84,000	86,000	86,000	10%	18%
Impact Sensitive Employment	82,000	85,000	88,000	90,000	91,000	11%	21%
Percent Impact Sensitive	19%	19%	19%	19%	19%		
Lafayette							
All-Industry Total	283,000	295,000	303,000	307,000	309,000	9%	100%
Ag Services, Forestry, Fisheries	3,000	4,000	4,000	4,000	4,000	19%	2%
Coastal Tourism/Travel	55,000	57,000	59,000	60,000	60,000	9%	20%
Impact Sensitive Employment	59,000	61,000	63,000	64,000	64,000	10%	22%
Percent Impact Sensitive	21%	21%	21%	21%	21%		
Lake Charles							
All-Industry Total	180,000	186,000	190,000	191,000	192,000	6%	100%
Ag Services, Forestry, Fisheries	2,000	2,000	2,000	2,000	2,000	23%	4%
Coastal Tourism/Travel	32,000	33,000	34,000	34,000	34,000	6%	18%
Impact Sensitive Employment	34,000	35,000	36,000	36,000	37,000	7%	22%
Percent Impact Sensitive	19%	19%	19%	19%	19%		

Table 4-10. Gulf of Mexico Proposed Action Sensitive Industry Projections (continued)

	2000	2005	2010	2015	2020	% Change to 2020	Proportion of Change
Houma							
All-Industry Total	144,000	148,000	149,000	149,000	149,000	3%	100%
Ag Services, Forestry, Fisheries	2,000	2,000	2,000	2,000	2,000	23%	10%
Coastal Tourism/Travel	26,000	26,000	27,000	27,000	27,000	3%	18%
Impact Sensitive Employment	28,000	29,000	29,000	29,000	29,000	5%	28%
Percent Impact Sensitive	19%	19%	19%	19%	20%		
Beaumont-Port Arthur							
All-Industry Total	263,000	285,000	304,000	320,000	335,000	27%	100%
Ag Services, Forestry, Fisheries	4,000	4,000	5,000	5,000	6,000	61%	3%
Coastal Tourism/Travel	38,000	41,000	44,000	46,000	49,000	27%	15%
Impact Sensitive Employment	42,000	45,000	49,000	51,000	54,000	30%	17%
Percent Impact Sensitive	16%	16%	16%	16%	16%		
Houston-Galveston							
All-Industry Total	2,401,000	2,585,000	2,747,000	2,871,000	2,984,000	24%	100%
Ag Services, Forestry, Fisheries	27,000	32,000	35,000	38,000	42,000	51%	2%
Coastal Tourism/Travel	380,000	409,000	435,000	454,000	472,000	24%	16%
Impact Sensitive Employment	408,000	441,000	470,000	493,000	514,000	26%	18%
Percent Impact Sensitive	17%	17%	17%	17%	17%		
Corpus Christi							
All-Industry Total	275,000	291,000	306,000	317,000	327,000	19%	100%
Ag Services, Forestry, Fisheries	5,000	5,000	6,000	6,000	7,000	47%	4%
Coastal Tourism/Travel	52,000	55,000	58,000	60,000	62,000	19%	19%
Impact Sensitive Employment	56,000	60,000	63,000	66,000	68,000	21%	23%
Percent Impact Sensitive	21%	21%	21%	21%	21%		
Brownsville-McAllen							
All-Industry Total	516,000	583,000	648,000	698,000	746,000	45%	100%
Ag Services, Forestry, Fisheries	15,000	17,000	19,000	20,000	20,000	34%	2%
Coastal Tourism/Travel	68,000	77,000	85,000	92,000	98,000	45%	13%
Impact Sensitive Employment	83,000	94,000	104,000	111,000	118,000	43%	15%
Percent Impact Sensitive	16%	16%	16%	16%	16%		

Table 4-10. Gulf of Mexico Proposed Action Sensitive Industry Projections (continued)

	2000	2005	2010	2015	2020	% Change to 2020	Proportion of Change
Victoria							
All-Industry Total	84,000	88,000	92,000	95,000	98,000	17%	100%
Ag Services, Forestry, Fisheries	1,000	1,000	2,000	2,000	2,000	43%	5%
Coastal Tourism/Travel	14,000	15,000	16,000	16,000	16,000	17%	17%
Impact Sensitive Employment	16,000	17,000	17,000	18,000	19,000	19%	21%
Percent Impact Sensitive	19%	19%	19%	19%	19%		
Brazoria							
All-Industry Total	169,000	180,000	191,000	200,000	206,000	22%	100%
Ag Services, Forestry, Fisheries	2,000	2,000	2,000	3,000	3,000	49%	3%
Coastal Tourism/Travel	30,000	32,000	34,000	35,000	36,000	22%	18%
Impact Sensitive Employment	32,000	34,000	36,000	38,000	39,000	24%	20%
Percent Impact Sensitive	19%	19%	19%	19%	19%		
Pensacola							
All-Industry Total	347,000	384,000	412,000	429,000	440,000	27%	100%
Ag Services, Forestry, Fisheries	4,000	5,000	5,000	6,000	6,000	53%	2%
Coastal Tourism/Travel	52,000	58,000	62,000	64,000	66,000	27%	15%
Impact Sensitive Employment	56,000	62,000	67,000	70,000	72,000	29%	17%
Percent Impact Sensitive	16%	16%	16%	16%	16%		
Panama City							
All-Industry Total	99,000	109,000	116,000	121,000	124,000	26%	100%
Ag Services, Forestry, Fisheries	2,000	2,000	2,000	3,000	3,000	49%	4%
Coastal Tourism/Travel	15,000	16,000	17,000	18,000	19,000	26%	15%
Impact Sensitive Employment	17,000	18,000	19,847	21,000	21,000	28%	19%
Percent Impact Sensitive	17%	17%	17%	17%	17%		
Tallahassee							
All-Industry Total	232,000	253,000	268,000	276,000	281,000	21%	100%
Ag Services, Forestry, Fisheries	4,000	5,000	6,000	6,000	6,000	43%	4%
Coastal Tourism/Travel	48,000	52,000	55,000	57,000	58,000	21%	21%
Impact Sensitive Employment	52,000	57,000	61,000	63,000	64,000	23%	25%
Percent Impact Sensitive	23%	23%	23%	23%	23%		

Table 4-10. Gulf of Mexico Proposed Action Sensitive Industry Projections (continued)

	2000	2005	2010	2015	2020	% Change to 2020	Proportion of Change
Lake City							
All-Industry Total	76,000	84,000	90,000	94,000	96,000	25%	100%
Ag Services, Forestry, Fisheries	1,000	1,000	1,000	1,000	1,000	38%	2%
Coastal Tourism/Travel	9,000	10,000	11,000	12,000	12,000	25%	12%
Impact Sensitive Employment	10,000	12,000	12,000	13,000	13,000	27%	14%
Percent Impact Sensitive	134%	14%	14%	14%	14%		
Gainesville							
All-Industry Total	183,000	200,000	214,000	221,000	226,000	24%	100%
Ag Services, Forestry, Fisheries	2,000	3,000	3,000	3,000	3,000	36%	2%
Coastal Tourism/Travel	20,000	22,000	24,000	24,000	25,000	24%	11%
Impact Sensitive Employment	23,000	25,000	26,000	27,000	28,000	25%	13%
Percent Impact Sensitive	12%	12%	12%	12%	12%		
Ocala							
All-Industry Total	180,000	203,000	222,000	234,000	241,000	34%	100%
Ag Services, Forestry, Fisheries	4,000	4,000	5,000	5,000	5,000	27%	2%
Coastal Tourism/Travel	27,000	30,000	33,000	35,000	36,000	34%	15%
Impact Sensitive Employment	31,000	35,000	38,000	40,000	41,000	33%	17%
Percent Impact Sensitive	17%	17%	17%	17%	17%		
Tampa							
All-Industry Total	1,126,000	1,200,000	1,251,000	1,274,000	1,278,000	13%	100%
Ag Services, Forestry, Fisheries	15,0000	16,000	17,000	17,000	17,000	18%	2%
Coastal Tourism/Travel	163,000	174,000	181,000	185,000	185,000	13%	15%
Impact Sensitive Employment	178,000	190,000	198,000	202,000	202,000	14%	16%
Percent Impact Sensitive	16%	16%	16%	16%	16%		
Sarasota							
All-Industry Total	331,000	361,000	385,000	398,000	403,000	22%	100%
Ag Services, Forestry, Fisheries	7,000	8,000	9,000	9,000	9,000	27%	3%
Coastal Tourism/Travel	43,000	47,000	50,000	51,000	52,000	22%	13%
Impact Sensitive Employment	50,000	55,000	58,000	60,000	61,000	23%	16%
Percent Impact Sensitive	15%	15%	15%	15%	15%		

Table 4-10. Gulf of Mexico Proposed Action Sensitive Industry Projections (continued)

	2000	2005	2010	2015	2020	% Change to 2020	Proportion of Change
Naples							
All-Industry Total	308,000	344,000	374,000	392,000	403,000	31%	100%
Ag Services, Forestry, Fisheries	9,000	10,000	11,000	11,000	11,000	20%	2%
Coastal Tourism/Travel	44,000	49,000	53,000	55,000	57,000	31%	14%
Impact Sensitive Employment	53,000	59,000	63,000	66,000	68,000	29%	16%
Percent Impact Sensitive	17%	17%	17%	17%	17%		
Miami							
All-Industry Total	1,940,000	2,082,000	2,184,000	2,235,000	2,250,000	16%	100%
Ag Services, Forestry, Fisheries	44,000	49,000	53,000	55,000	57,000	30%	4%
Coastal Tourism/Travel	269,000	289,000	303,000	310,000	313,000	16%	14%
Impact Sensitive Employment	313,000	338,000	356,000	365,000	369,000	18%	18%
Percent Impact Sensitive	16%	16%	16%	16%	16%		

Table 4-11. Estimated Average Emissions for the Cumulative OCS Program, Gulf of Mexico Region

Activity	Pollutant (tons/yr)				
	NO_x	SO_2	PM_{10}	CO	VOC
Service Vessels	10,167-13,743	2,070-2,798	1,155-1,561	2,001-2,705	871-1,177
Pipeline Vessels	521-1,495	73-208	22-62	175-501	48-137
Helicopters	142-190	28-38	32-43	336-450	24-33
Tanker and Barge Fugitives	0	0	0	0	1,767-2,557
Tanker and Barge Exhaust	360-521	181-262	57-83	37-54	10-15
Platform Construction	10,475-14,042	596-799	140-188	2,069-2,773	615-824
Exploration Wells	2,969-3,740	328-414	82-103	791-996	274-345
Production Wells	6,127-7,538	689-847	167-205	1,568-1,927	566-696
Production Platforms	52,661-71,741	8,849-12,056	963-1,311	12,254-16,694	39,930-54,398
Total	83,422-113,009	12,816-17,423	2,618-3,556	19,231-26,101	44,105-60,181

APPENDIX A

A. Glossary

anadromous fish – fish that migrate up river from the sea to breed in fresh water.

anthropogenic – coming from human sources, relating to the effect of man on nature.

aphotic zone – Zone where the levels of light entering through the surface are not sufficient for photosynthesis or for animal response.

aromatic – applied to a class of organic compounds containing benzene rings or benzenoid structures.

attainment area – an area which is classified by the USEPA as meeting the primary or secondary ambient air quality standards for a particular air pollutant based on monitored data.

barrel – equal to 42 U.S. gallons.

benthic – bottom dwelling, associated with (in or on) the seafloor.

benthic macroinvertebrate – animals such as worms, clams, or crabs which are large enough to see without the aid of a microscope.

benthos – organisms which dwell in or on the seafloor, the organisms living in or associated with the benthic (or bottom) environment.

biological opinion – an appraisal from either the Fish and Wildlife Service or the National Marine Fisheries Service evaluating the impact of a proposed Federal action, if it is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat, as required by Section 7 of the Endangered Species Act.

bivalves – general term for two-shelled mollusks (clams, oysters, scallops, mussels).

blowout – refers to an uncontrolled flow of fluids from a wellhead or wellbore. Unless otherwise specified, a flow of fluids from a flowline is not considered a blowout as long as the wellhead control valves can be automatically or manually activated. If the wellhead control valves become inoperative, the flow is classified as a blowout. A blowout can also occur below the seabed, from one formation to another.

carrying capacity – the maximum number or weight of individuals that can exist in a given habitat; an appraisal from either FWS or NMFS evaluating the impact of a proposed activity on endangered and threatened species.

cetacean – any of an order (Cetacea) of aquatic mostly marine mammals including the whales, dolphins, porpoises and related forms with large head, fusiform nearly hairless body, and paddle-shaped forelimbs, vestigial concealed hind limbs, and horizontal flukes (tails).

coastal waters – those waters surrounding the continent which exert a measurable influence on uses of the land.

coastal wetlands – include forested and nonforested habitats, mangroves, and all marsh islands which are exposed to coastal waters. Included in forested wetlands are hardwood hammocks, cypress-tupelogum swamps, and fluvial vegetation/bottomland hardwoods. Nonforested wetlands include fresh, brackish, and salt marshes. These areas directly contribute to the high biological productivity of coastal water by input of detritus and nutrients, by providing nursery and feeding areas for shellfish and finfish, by serving as habitat for many birds and other animals, and by providing waterfowl hunting and fur trapping.

coastal zone – the coastal waters (including the lands therein and thereunder) and the adjacent shore lands (including the waters therein and thereunder), strongly influenced by each other and in proximity to the shorelines of the several coastal States, and includes islands, transitional and intertidal areas, salt marshes, wetlands, and beaches. The zone extends seaward to the outer limit of the United States territorial sea. The zone extends inland from the shorelines only the extent necessary to control shore lands, the uses of which have a direct and significant impact on the coastal waters. Excluded from the coastal zone are lands the use of which is by law subject to the discretion of or which is held in trust by the Federal government, its officers, or agents. (The State land and water area officially designated by the State as “coastal zone” in its State coastal zone program as approved by the Department of Commerce under the CZMA).

coastal zone consistency review – State review of direct Federal activities, or private individual activities requiring Federal licenses or permits, and OCS plans pursuant to the CZM Act to determine if the activity is consistent with the enforceable policies of the State’s Federally approved CZM program.

continental shelf – a broad, gently sloping, shallow feature extending from the shore to the continental slope, generally considered to exist to the depth of 200m; that part of continental margin between continental shelf and continental rise (or oceanic trench).

continental slope – a relatively steep, narrow feature paralleling the continental shelf; the region in which the steepest descent to the ocean bottom occurs.

contingency plan – a plan for possible offshore emergencies prepared and submitted by the oil or gas operator as part of the Plan of Development and Production, and may be required for part of the Plan of Exploration.

critical habitat – a designated area that is essential to the conservation of an endangered or threatened species.

crude oil – a mixture of liquid hydrocarbons that exists in natural underground reservoirs as distinguished from refined oils manufactured from it.

crustaceans – any aquatic invertebrate with jointed legs, such as crabs, shrimp, lobster, barnacles, amphipods, isopods, etc.; primarily an aquatic group.

delineation well – an exploratory well drilled to define the areal extent of a field. Also referred to as an “expendable well.”

development – activities that take place following discovery of minerals in paying quantities, including geophysical activity, drilling, platform construction, and operation of all onshore support facilities, and that are for the purpose of ultimately producing the minerals discovered.

development and production plan (DPP) – a plan describing the specific work to be performed on an offshore lease, including all development and production activities that the lessee proposes to undertake during the time period covered by the plan and all actions to be undertaken up to and including the commencement of sustained production. The plan also includes descriptions of facilities and operations to be used, well locations, current geological and geophysical information, environmental safeguards, safety standards and features, time schedules, and other relevant information. All lease operators are required to formulate and obtain approval of such plans by MMS before (approval of) development and production activities may begin (can be given); requirements for submittal of DPP are wholly identified in 30 CFR 250.34.

development well – a well drilled into a known producing formation in a previously discovered field, to be distinguished from a wildcat, exploratory well, or an offset well.

dilution – the reduction in the concentration of dissolved or suspended substances by mixing with water.

discharge – something that is emitted; flow rate of a fluid at a given instant expressed as volume per unit of time.

dispersion – a distribution of finely divided particles in a medium.

drillship – a self-propelled, self-contained vessel equipped with a derrick amidship for drilling wells in deepwater.

drilling mud – a special mixture of clay, water, or refined oil, and chemical additives pumped downhole through the drill pipe and drill bit. The mud cools the rapidly rotating bit, lubricates the drill pipe as it turns in the wellbore, carries rock cuttings to the surface, serves to keep the hole from crumbling or collapsing, and provides the weight or hydrostatic head to prevent extraneous fluids from entering the wellbore and to control downhole pressures that may be encountered (drilling fluid).

effluent – the liquid waste of sewage and industrial processing.

emission offset – Emission reductions obtained from facilities, either onshore or offshore, other than the facility or facilities covered by the proposed Exploration Plan or Development and Production Plan The emission reductions achieved must be sufficient so that there will be no net increase in emissions for the area.

endangered and threatened species (endangered species) – This refers to any species which is in danger of extinction throughout all or a significant portion of its range and has been officially listed by the appropriate Federal or State agency; a species is determined to be endangered (or threatened) because of any of the following factors: (a) the present or threatened destruction, modification, or curtailment of its habitat or range; (b) over utilization for commercial, sporting, scientific, or educational purposes; (c) disease or predation; (d) the inadequacy of existing regulatory mechanisms; or (e) other natural or man-made factors affecting its continued existence.

environmental assessment – a concise public document required by NEPA. In the document, a Federal agency proposing (or reviewing) an action provides evidence and analysis for determining whether it must prepare an EIS or whether it finds there is no significant impact i.e., FONSI.

environmental effect – a measurable alteration or change in environmental conditions.

environmental impact statement (EIS) – a statement required by the National Environmental Policy Act of 1969 (NEPA) or similar State law in relation to any major action significantly affecting the environment; a NEPA document.

essential fish habitat (EFH) – those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. This includes areas that are currently or historically used by fish, or that have substrate such as sediment, hard bottom, bottom structures, or associated biological communities required to support a sustainable fishery.

estuary – semi-enclosed coastal body of water which has a free connection with the open sea and within which seawater is measurably diluted with freshwater; semi-enclosed coastal body of water which has a free connection with the open sea and within which seawater is often measurably diluted with freshwater.

exclusive economic zone – the maritime region adjacent to the territorial sea, extending 200 nautical miles from the baseline of the territorial sea, in which the United States has exclusive rights and jurisdiction over living and nonliving natural resources. (see "EEZ").

exploration – the process of searching for minerals. Exploration activities include: (1) geophysical surveys where magnetic, gravity, seismic, or other systems are used to detect or infer the presence of such minerals and; (2) any drilling, except development drilling, whether on or off known geological structures. Exploration also includes the drilling of a well in which a discovery of oil or natural gas in paying quantities is made and the drilling, after such a discovery, of any additional well that is needed to delineate a reservoir and to enable the lessee to determine whether to proceed with development and production.

exploration plan (EP) – a plan submitted by a lessee (30 CFR 250.33) that identifies all the potential hydrocarbon accumulations and wells that the lessee proposes to drill to evaluate the accumulations within the lease or unit area covered by the plan. All lease operators are required to obtain approval of such a plan by a Regional Supervisor before exploration activities may commence.

exploratory well – a well drilled in unproven or semi-proven territory for the purpose of ascertaining the presence underground of a commercially producible deposit of petroleum or natural gas.

fault – a fracture in the earth's crust accompanied by a displacement of one side of the fracture with respect to the other.

fauna – the animals of a particular region or time.

fixed or bottom founded – permanently or temporarily attached to the seafloor.

flyway – an established air route of migratory birds.

formation – a bed or deposit sufficiently homogeneous to be distinctive as a unit. Each different formation is given a name, frequently as a result of the study of the formation outcrop at the surface and sometimes based on fossils found in the formation.

fugitive emissions – Emission into the atmosphere which could not reasonably pass through a stack, chimney, vent or other functionally equivalent opening.

geologic hazard – a feature or condition that, if unmitigated, may seriously jeopardize offshore oil and gas exploration and development activities. Mitigation may necessitate special engineering procedures or relocation of a well.

geophysical – of or relating to the physics of the earth, especially the measurement and interpretation of geophysical properties of the rocks in an area.

geophysical data – facts, statistics, or samples which have not been analyzed or processed, pertaining to gravity, magnetic, seismic, or other surveys/systems.

geophysical survey – The exploration of an area during which geophysical properties and relationships unique to the area are measured by one or more geophysical methods.

habitat – a specific type of place that is occupied by an organism, a population, or a community; a specific type of place defined by its physical or biological environment that is occupied by an organism, a population, or a community.

haul-out area – specific locations where pinnipeds come ashore and concentrate in numbers to rest, breed, and/or bear young.

herbivores – animals whose diet consists of plant material.

H_2S – hydrogen sulfide.

hydrocarbon – any of a large class of organic compounds containing primarily carbon and hydrogen, comprising paraffins, olefins, members of the acetylene series, alicyclic hydrocarbons, and aromatic hydrocarbons, and occurring in many cases in petroleum, natural gas, coal, and bitumens.

hypothermia – subnormal temperature of the body, usually due to excessive heat loss.

incidental take – Take of a threatened or endangered fish or wildlife species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by a Federal agency or applicant.

indirect effects – effects caused by activities which are stimulated by an action but not directly related to it.

industry infrastructure – the facilities associated with oil and gas development, e.g., refineries, gas processing plants, etc.

information to lessees – information included in the Notice of Sale to alert lessees and operators of special concerns in or near a sale area of regulatory provisions enforceable by Federal or State agencies.

jack-up rig – a barge-like, floating platform with legs at each corner that can be lowered to the sea bottom to raise the platform above the water; a drilling platform with retractable legs that can be lowered to the sea bottom to raise the platform above the water.

landfall – the site at which a marine pipeline comes to shore.

lay barge – a shallow-draft, barge-like vessel used in the construction and laying of underwater pipelines.

lighter – a barge or small tanker used to move cargo from a large ship to port; also, to transport by lighter.

macroinvertebrate – animals such as worms, clams, or crabs which are large enough to be seen without the aid of a microscope.

mariculture – the breeding or growth of marine animals and plants to increase their stocks.

marine sanctuary – area protected under the Marine Protection, Research and Sanctuaries Act of 1972.

marshes – persistent emergent nonforested wetlands characterized by vegetation consisting predominantly of cordgrasses, rushes, and cattails.

microcrustacean – any relatively small crustacean (may range from microscopic to slightly over one centimeter in size) including organisms such as beach hoppers (amphipods), copepods, ostracods, isopods, and mysids.

military warning area – an area established within which the public is warned that military activities take place.

mollusks – animal phylum characterized by soft body parts including clams, mussels, snails, squid, and octopus.

mud – the liquid circulated through the wellbore during rotary drilling operations. In addition to its function of bringing cuttings to the surface, drilling mud cools and lubricates the bit and drill stem, protects against blowouts by holding back subsurface pressures and deposits a mud cake on the wall of the borehole to prevent loss of fluids to the formations, also called drilling mud or drilling fluid; also a sediment designation composed of silt and clay sized particles.

mysids – small shrimp-like organisms, also known as opossum shrimp due to their method of egg incubation.

natural gas – hydrocarbons that are in a gaseous phase under atmospheric conditions of temperature and pressure.

nearshore waters – Offshore, open waters that extend from the shoreline out to the limit of the territorial seas (12 nautical miles).

nonattainment area – an area which is classified by the USEPA as not meeting the primary or secondary ambient air quality standards for a particular pollutant based on monitored data.

offloading – another name for unloading; offloading refers more specifically to liquid cargo, crude oil, and refined products.

oil spill contingency plan – a plan submitted by the lease or unit operator along with or prior to a submission of a plan of exploration or a development/production plan that details provisions for fully defined, specific actions to be taken following discovery and notification of an oil spill.

operational discharge – a release of oil that is part of the routine operation of a function.

operator – the person or company engaged in the business of drilling for, producing, or processing oil, gas, or other minerals and recognized by the MMS as the official contact and responsible for the lease activities or operations.

organic matter – material derived from living plant or animal organisms.

Outer Continental Shelf (OCS) – all submerged lands that comprise the continental margin adjacent to the United States and seaward of State offshore lands.

petroleum – an oily, flammable bituminous liquid that occurs in many places in the upper strata of the earth, either in seepages or in reservoirs; essentially a complex mixture of hydrocarbons of different types with small amounts of other substances; any of various substances (as natural gas or shale oil) similar in composition to petroleum.

phytoplankton – plant (photosynthetic) plankton; microscopic, freefloating, photosynthetic organisms that drift passively in the water.

pinniped – any of a suborder (Pinnipedia) of aquatic carnivorous mammals (e.g., seals, sea lions, sea otters, walruses) with all four limbs modified into flippers; any of a suborder (Pinnipedia) of aquatic carnivorous mammals (e.g., seals, sea lions, walruses) with all four limbs modified into flippers.

plankton – passively floating or weakly motile aquatic plants and animals.

planning area – a subdivision of an offshore area used as the initial basis for considering blocks to be offered for lease in the DOI's areawide offshore oil and gas leasing program.

platform – a steel, concrete, or gravel structure from which offshore development wells are drilled; structure can be nonplatform or platform.

postlease – any activity on a block or blocks after the issuance of a lease on said block or blocks.

potential impact (effect) – the range of alterations or changes to environmental conditions that could be caused by an action.

primary production – production of carbon by a plant through photosynthesis over a given period of time; oil and gas production that occurs from the reservoir energy inherent in the formation.

production – activities that take place after the successful completion, by any means, for the removal of minerals, including such removal, field operations, transfer of minerals to shore, operation monitoring, maintenance, and workover drilling.

production well – a well which is drilled for the purpose of producing oil or gas reserves. It is sometimes termed development well.

prospect – an untested geologic feature having the potential for trapping and accumulating hydrocarbons.

recoverable reserves – Portion of the identified oil or gas resource that can be economically extracted under current technological constraints.

recoverable resource estimate – an assessment of oil and gas resources that takes into account the fact that physical and technological constraints dictate that only a portion of resources or reserves can be brought to the surface.

refining – fractional distillation, usually followed by other processing (for example, cracking).

reserves – portion of the identified oil or gas resource that can be economically extracted.

reservoir – a subsurface, porous, permeable rock body in which hydrocarbons have accumulated.

resources – concentrations of naturally occurring solid, liquid, or gaseous materials in or on the Earth's crust some part of which is currently or potentially extractable. These include both identified and undiscovered resources.

rig – a structure used for drilling an oil or gas well.

right-of-way – a legal right of passage, an easement; the specific area or route for which permission has been granted to place a pipeline, (and) ancillary facilities, and for normal maintenance thereafter.

rookery – the nesting or breeding grounds of gregarious (i.e., social) birds or mammals; also a colony of such birds or mammals.

sale area – the geographical area of the OCS being offered for lease for the exploration, development, and production of mineral resources.

scoping – the process prior to EIS preparation to determine the range and significance of issues to be addressed in the EIS for each proposed major federal action.

seagrass beds – more or less continuous mats of submerged rooted marine flowering vascular plants occurring in shallow tropical and temperate waters. Seagrass beds provide habitat, including breeding and feeding grounds for adults and/or juveniles of many of the economically important shellfish and finfish.

seeps-petroleum – Gas or oil that reaches the surface along bedding planes, fractures, unconformities or fault planes through connected porous rocks.

seismic – pertaining to, characteristic of, or produced by earthquakes or earth vibration; having to do with elastic waves in the earth, also geophysical when applied to surveys.

semisubmersible – a floating offshore drilling structure that has hulls submerged in the water but not resting on the seafloor.

shunting – a method used in offshore oil and gas drilling activities where expended drill cuttings and fluids are discharged near the ocean seafloor rather than at the surface, as in the case of normal offshore drilling operations.

stipulations – specific measures imposed upon a lessee that apply to a lease. Stipulations are attached as a provision of a lease; they may apply to some or all tracts in a sale. For example, a stipulation might limit drilling to a certain time period of the year or certain areas.

subsistence uses – the customary and traditional uses by rural residents of wild, renewable resources of direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for making and selling of handcraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade.

supply boat – a vessel that ferries food, water, fuel, and drilling supplies and equipment to a rig and returns to land with refuse that cannot be disposed of at sea.

take – to harass, harm, pursue, hunt, shoot, wound, kill, capture, or collect a threatened or endangered fish or wildlife species, or attempt to engage in any such conduct. (Harm includes habitat modification that impairs behavioral patterns and harass includes actions that create the likelihood of injury to an extent that normal behavior patterns are disrupted).

threatened species – refers to any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range and has been officially listed by the appropriate Federal agency; criteria for determination of threatened status can be found under "endangered species."

trawl – a large, tapered fishing net of flattened, conical shape that is typically towed along the seabottom.

trophic – trophic levels refer to the hierarchy of organisms from photosynthetic plants to carnivores, such as man; feeding trophic levels refer to the hierarchy of organisms from photosynthetic plants to carnivores in which organisms at one level are fed upon by those at the next higher level (e.g., phytoplankton eaten by zooplankton eaten by fish).

trunk line – A pipeline for the transportation of oil and or gas from producing areas to refineries or terminals.

turbidity – reduced water clarity resulting from the presence of suspended matter.

vascular plants -plants containing food and water conducting structures; higher plants which reproduce by seeds.

volatile organic compound (VOC) – Any reactive, organic compound which is emitted to the atmosphere as a vapor. The definition does not include methane.

vulnerability -the likelihood of being damaged by external influences. Vulnerability implies sensitivity of a system plus the risk of a damaging influence occurring.

weathering – the aging of oil due to its exposure to the atmosphere and environment causing marked alterations in its physical and chemical makeup.

wetlands – areas periodically inundated or saturated by surface or groundwater and predominantly supporting vegetation typically adapted for life in saturated soil conditions.

zooplankton – animal plankton, mostly dependent on phytoplankton for its food source; animal plankton, small, freefloating animals, may be passive drifters or motile, dependent on phytoplankton as a food source.

APPENDIX B

B. ABBREVIATIONS AND ACRONYMS

ACP	Area Contingency Plan
ADCED	Alaska Department of Commercial and Economic Development
ADFG	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
AEWC	Alaska Eskimo Whaling Commission
ANCSA	Alaska Native Claims Settlement Act
ANILCA	Alaska National Interest Lands Conservation Act
ANWR	Arctic National Wildlife Refuge
API	American Petroleum Institute
ASTM	American Society for Testing and Materials
ATOC	Acoustic Thermometry of Ocean Climate
BACT	Best Available Control Technology
bbl	barrels
BLM	Bureau of Land Management
B.P.	before present
BPXA	British Petroleum Exploration Alaska
BTEX	benzene, toulene, ethylbenzene & xylene
^{o}C	degrees Centrigrade
^{14}C	carbon-14
CAA	Clean Air Act
CAH	Central Arctic Herd
CCC	California Coastal Commission
CEC	Commission on Environmental Cooperation
CEI	Coastal Environments, Inc.
CEQ	Council on Environmental Quality
CER	categorical exclusion review
CFC	chloroflurocarbons
CFEC	Commercial Fisheries Entry Commission (State of Alaska)
CFR	Code of Federal Regulations
CH_4	methane
CIAP	Coastal Impact Assistance Program
cm	centimeter

cm/s	centimeter per second
CMP	coastal management program
CO	carbon monoxide
CO_2	carbon dioxide
COE	Corps of Engineers (U.S. Army)
COTP	captain–of–the–port
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
db	decibel
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DEW	distant early warning
DO	dissolved oxygen
DOCD	Development Operations Coordination Document
DPP	development and production plan
EA	environmental assessment
EEZ	Exclusive Economic Zone
EFH	essential fisheries habitat
EIS	environmental impact statement
EJ	Environmental Justice
EO	Executive Order
EOR	Enhanced Oil Recovery
EP	exploration plan
ERS	Economic Research Service (U.S. Department of Agriculture)
ESA	Endangered Species Act
ESP	Environmental Studies Program
^{o}F	degrees Fahrenheit
FAD	fish attracting device
FCF	Fisherman's Contingency Fund
FCMA	Fishery Conservation and Management Act of 1976
FMC	fishery management council
FMP	fishery management plan
FONSI	finding of no significant impact
FOSC	Federal On-Scene Coordinator

FR	Federal Register
FSB	Federal Subsistence Board (USDOI)
FWPCA	Federal Water Pollution Control Act
FWS	Fish and Wildlife Service (USDOI)
g	gram
g/L	grams per liter
GCM	global climate models
GIS	Geographic Information System
GMAQS	Gulf of Mexico Air Quality Study
GMFMC	Gulf of Mexico Fisheries Management Council
gpd	gallons per day
GRASP	Geologic Resource Assessment Program
ha	hectare
HAPC	habitat area of particular concern
hr	hour
Hz	hertz
IAI	Impact Assessment, Inc.
ICN	Independent Contractor Network
IPCC	Intergovernmental Panel on Climate Change
IR	infrared
IWC	International Whaling Commission
kg	kilogram
kg/yr	kilograms per year
kHz	kilohertz
km	kilometer
km^2	square kilometer
km/hr	kilometers per hour
KPB	Kenai Peninsula Borough
L	liter
lb	pound
LC_{50}	lethal concentration resulting in 50% mortality
LMA	labor market area
LNG	liquified natural gas
m	meter

m^3	cubic meter
m/yr	meters per year
MARPOL	International Convention for the Prevention of Pollution from Ships
ml	milliliter
ml/L	milliliters per liter
MM	million
MMm^3	million cubic meters
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MODU	mobile drilling unit
MOU	Memorandum of Understanding
MPA	marine protected area
MPRCA	Marine Plastic Pollution Research and Control Act
MPRSA	Marine Protection Research and Sanctuaries Act of 1972
MRFSS	Marine Recreational Fisheries Statistics Survey (NMFS)
MSA	metropolitan statistical area
MSIS	Marine Safety Information System
MSRC	Marine Spill Response Corporation
NAAQS	National Ambient Air Quality Standards
NAFTA	North Atlantic Free Trade Agreement
NAS	National Academy of Science
NASA	National Aeronautics & Space Administration
NCP	National Contingency Plan
NDBC	National Data Buoy Center
NEPA	National Environmental Policy Act
NEPD	National Energy Policy Development (Group)
NGL	natural gas liquids
NHPA	National Historic Preservation Act
NIST	National Institute of Standards and Technology
NMFS	National Marine Fisheries Service
N_2O	nitrous oxides
NO_2	nitrogen dioxide
NO_x	nitrogen oxide
NOAA	National Oceanic and Atmospheric Administration

NOI	Notice of Intent
NORCOR	NORCOR Engineering Research, Ltd.
NORM	naturally occurring radioactive material
NPDES	National Pollutant Discharge Elimination System
NPR–A	National Petroleum Reserve–Alaska
NRC	National Research Council
NR Corp.	National Response Corporation
NRDA	Natural Resource Damage Assessment
NRT	National Response Team
NSB	North Slope Borough
NS&T	National Status and Trends Program (NOAA)
NTL	Notice to Lessees
NWAB	Northwest Arctic Borough
O_3	ozone
OCS	Outer Continental Shelf
OCSEAP	Outer Continental Shelf Environmental Assessment Program
OCSLA	Outer Continental Shelf Lands Act
OHMSETT	Oil and Hazardous Materials Simulated Test Tank
OPA	Oil Pollution Act
OSFR	oil–spill financial responsibility for offshore facilities
OSHA	Occupational Safety and Health Administration
OSR Program	Oil–Spill Research Program
OSRP	Oil–Spill Response Plans
OSRO	Oil Spill Removal Organization
OSRV	offshore response vessel
PAH	polyaromatic hydrocarbons
Pb	ead
PCB	polychlorinated biphenyl
PCH	Porcupine Caribou Herd
Pci/L	picocuries per liter
PEL	permissible exposure limit
PFMC	Pacific Fisheries Management Council
PM_{10}	10–micron particulate matter
PM_{25}	25–micron particulate matter

ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
PRESTO	probabilistic resource estimates offshore
PSD	Prevention of Significant Deterioration
QI	qualified individual
RCP	Regional Contingency Plan
RCRA	Resource Conservation and Recovery Act
RP	responsible party
RRT	Regional Response Team
s	second
SAIC	Science Applications International Corporation
SBC	Santa Barbara Channel
SBF	synthetic–based fluids
SCB	Southern California Bight
SCCWRP	Southern California Coastal Water Research Project
SIP	State Implementation Plan
SO_2	sulfur dioxide
SWFMC	Southwest Fisheries Management Council
t	metric ton
TAPS	Trans–Alaska Pipeline System
TCE	metric tons carbon equivalent
TED	turtle excluder device
TEIA	Transboundary Environmental Impact Assessment
TLH	Teshekpuk Lake Herd
µg	microgram
µPa	microPascal
USAEDA	U.S. Army Engineer District, Alaska
USCG	U.S. Coast Guard
USDOC	U.S. Department of Commerce
USDOD	U.S. Department of Defense
USDOI	U.S. Department of the Interior
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency

USGS	U.S. Geological Survey
VOC	volatile organic compounds
VOSS	vessel of opportunity skimming systems
WAH	Western Arctic Herd
WBF	water-based fluid

APPENDIX C

C. OIL-SPILL RESPONSE CAPABILITIES FOR OFFSHORE OIL AND GAS OPERATIONS

1. Introduction

a. Background

In 1985, the National Academy of Sciences (NAS) conducted a study of the sources of oil in the ocean (*Oil in the Sea: Inputs, Fates, and Effects*) and found the following facts about oil in the world's oceans (NAS, 1985):

- 36 percent came from municipal and industrial wastes and runoff;
- 34 percent came from tanker operations and accidents;
- 11 percent came from other marine transportation and marine terminals;
- 9 percent came from the atmosphere;
- 8 percent came from natural sources including marine seeps and sediments; and
- 2 percent came from offshore production operations worldwide.

The NAS is updating this study for 2001, but has not officially released the results.

For several years, the United States has been importing over half of the oil it consumes (currently over 55%). This means that over half of all U.S. oil arrives by tankers—a transportation mode that contributes 34 percent of all the oil in the world's oceans. (When tanker operations and tanker accidents are added to other marine transportation and marine terminals, sea transportation contributes 45 percent of all oil in the sea.)

This appendix is concerned with the current capabilities of the oil industry to respond to potential spills related to oil and gas leasing activities on the Outer Continental Shelf (OCS). Federal OCS oil and gas leasing activities and offshore production operations in State and foreign waters contribute about 2 percent of the oil in the world's oceans.

A 1969 blowout and oil spill in the Santa Barbara Channel and two 1970 blowouts and associated fires in the Gulf of Mexico raised public concern over potential spills from OCS oil and gas operations. The U.S. Geological Survey (USGS), the U.S. Department of the Interior (USDOI), Minerals Mangement Service’s (MMS's) predecessor for regulating offshore operations, adopted stricter requirements, both to prevent oil and gas discharges and to respond to such discharges when they occur. The USGS and MMS have continuously reviewed and modified these requirements since 1969, so that offshore drilling and production facilities have had a 20-year head start in oil-spill response planning compared to vessels and onshore facilities. Vessels and onshore facilities did not have to meet oil-spill response planning requirements until passage of the Oil Pollution Act (OPA) in 1990.

Two key factors in determining the success or failure of spill response are preparedness and response time. Offshore spill response is generally successful when response crews and equipment are adequately prepared and immediately available to respond to a spill.

b. MMS Oil-Spill Research Program

The MMS is the principal U.S. Government Agency funding offshore oil-spill response research, and for more than 20 years, it has maintained a comprehensive, long-term research Oil-Spill Research Program (OSR Program). The MMS has recognized expertise in oil-spill preparedness, mechanical containment and recovery of spilled oil, and "in situ burning," whereby spilled oil is burned instead of recovered. The MMS expanded the scope of its OSR Program in 1986 by aligning it with programs at the U.S. National Institute of Standards and Technology (NIST) and Environment Canada, Canada's environmental protection agency. The NIST possesses considerable expertise on in situ burning and burn products, and Environment Canada is recognized for its expertise in chemical treating agents and detection.

The OSR Program brings together, through cooperative research agreements and contracts, expertise in all areas of oil-spill response. The MMS, other U.S. agencies, foreign government agencies, and the oil industry jointly contribute research funding. The OSR Program participates in about 30 concurrent research and development projects. The MMS has cooperated in the exchange of technological information with Norway, United Kingdom, Japan, and France through informal contacts, workshops, and technical meetings such as the biennial International Oil Spill Conference.

Funding for the OSR Program and operation of the Oil and Hazardous Materials Simulated Environmental Test Tank (OHMSETT)—the national oil-spill response test facility—are appropriated from the Oil Spill Liability Trust Fund, which receives funds from a $0.05 tax on each barrel of oil produced or imported into or out of the country. As intended by the OPA of 1990, the companies that produce and transport oil support research to improve oil-spill response capabilities.

Current OSR Program projects include laboratory, mesoscale and full-scale experiments, and field investigations. Major topic areas include: remote sensing and detection, mechanical containment and recovery, physical and chemical properties of crude oil, chemical treating and dispersants, in situ burning, deepwater operations, and operation and maintenance of OHMSETT, located in Leonardo, New Jersey.

c. Federal Government Contingency Plan Network

The OPA of 1990 amended section (§) 311(c) of the Federal Water Pollution Control Act (FWPCA) and, in turn, the National Oil and Hazardous Substance Pollution Contingency Plan, or National Contingency Plan (NCP). The NCP was developed according to the FWPCA and the Comprehensive Environmental Response Compensation and Liability Act of 1980. Under Title 40 of the Code of Federal Regulations, Part 300 (40 CFR 300), the NCP establishes responsibilities and criteria for responding to oil spills and spills of hazardous substances.

The NCP establishes a system of interlocking response teams, with the National Response Team (NRT) responsible for overall coordination among Regional Response Teams (RRT's). The U.S. Environmental Protection Agency (USEPA) and the U.S. Coast Guard (USCG) jointly chair the NRT and the RRT's. The RRTs are designated for intergovernmental planning and coordination of preparedness and response actions and are responsible for preparing Regional Contingency Plans (RCP's). An RRT is established for each standard Federal region, except for Alaska, Oceania in the Pacific, and the Caribbean area. Each of these three areas has its own separate-standing RRT. The RCP's fulfill the same requirements on a regional level as the NCP does for the nation. Draft NCP's and RCP's are published in the *Federal Register* (FR) with an appropriate time set for review and comment by interested parties.

Generally, the USEPA has Federal On-Scene Coordinator responsibility for spills onshore, and the USCG has Federal On-Scene Coordinator responsibility for spills in major bodies of water inland and in coastal and offshore areas. Specific boundaries for USEPA or USCG jurisdiction are determined by agreement in the Federal RCP’s. As planning proceeds toward the local level, each successive level of planning should contain more site-specific information to permit quick organization of an effective response to any oil spill.

When a spill occurs in coastal and offshore navigable waters of the United States, the USCG Captains-of-the-Port (COTP’s) are designated as the Federal On-Scene Coordinators. There are currently 49 COTP areas. Generally, each COTP serves as predesignated On-Scene Coordinator for each port area. (The 10 USEPA Regional Administrators have designated about 200 On-Scene Coordinators for inland areas.)

An RRT can be convened at the request of a Federal On-Scene Coordinator for coordination and advice during a spill incident. Each RRT is comprised of representatives with environmental expertise from about 15 Federal, State, and local agencies, and Indian tribes. The USDOI has a member on each RRT to assist an On-Scene Coordinator during a spill by providing expertise concerning fish and wildlife habitat. The National Oceanic and Atmospheric Administration provides a Scientific Support Coordinator to coordinate and develop scientific response information, as needed.

The FWPCA, as amended by the OPA, establishes Area Committees which are responsible for preparing Area Contingency Plans (ACP’s). Federal On-Scene Coordinators and Area Committees are responsible for ensuring that Federal, State, and local response agencies and actions are fully coordinated, especially concerning the use of dispersants or in situ burning.

d. MMS Regulatory Authority for Oil-Spill Planning and Response

Both the OCS Lands Act and the FWPCA contain requirements for oil-spill prevention and cleanup. The OCS Lands Act assigns responsibility for the enforcement of safety and environmental regulations on the OCS to the USDOI Secretary; "the Secretary of the Department in which the Coast Guard is operating"; and the Secretary of the Army. The USCG is currently under the U.S. Department of Transportation (USDOT).

Executive Order (E.O.) 12777 delegates the President's OPA and FWPCA responsibilities to various Federal Agencies. It empowers the Secretary of the Interior to regulate oil-spill prevention and oil-spill response planning for all offshore oil and gas facilities and associated pipelines, including those located in State waters. This includes regulating the preparation and submittal of Oil-Spill Response Plans (OSRP’s). The MMS has been actively coordinating its OPA responsibilities with States affected by offshore leasing such as Alaska, California, Texas, and Louisiana.

Under E.O. 12777, the USDOI, the USDOT, and the USEPA have overlapping responsibilities for oil and gas exploration and production activities. To reduce regulatory confusion, the USDOI, the USDOT, and the USEPA entered into a Memorandum of Understanding (MOU) under E.O. 12777. In this MOU, the Agencies divided their respective responsibilities for oil-spill prevention and response according to the definition of "coast line" contained in the Submerged Lands Act. (See 59 FR 9494-9495, Monday, February 28, 1994.)

In March 1997, MMS issued a final rule concerning "Response Plans for Facilities Located Seaward of the Coast Line," (See 62 FR 13991-14003, Tuesday, March 25, 1997.) This regulation is found at 30 CFR 254, and it replaced MMS's pre-OPA oil-spill response regulations in 30 CFR 250.

All OSRPs are reviewed and commented on by other Federal and State agencies—especially USCG. The lessee is the designated "responsible party" (RP) under the OPA and the NCP, and is therefore responsible for responding to a spill under its OSRP. The RP's are required to have the resources necessary to respond commensurate with their exploration or development activity. They are responsible for taking immediate corrective action when a spill occurs. However, if the spill (1) constitutes a substantial threat to the public health or welfare, or (2) is a worst-case discharge for the facility in question, then the Federal On-Scene Coordinator would usually direct all containment and cleanup efforts.

The Federal On-Scene Coordinator is required to make a reasonable effort to have the discharger voluntarily and promptly perform removal actions. The Federal On-Scene Coordinator may also direct and monitor cleanup progress and provide advice and counsel to the RP as necessary. The method of response to a particular spill will depend on many factors including the function of industry spill response cooperatives, the location of the spill in relation to sensitive environmental areas, distance to shore, prevailing weather conditions, and prevailing sea conditions. These factors vary significantly, and planned response actions vary accordingly.

When an oil spill results from oil and gas activity on the OCS, the MMS maintains oversight responsibility for operations on the OCS facility. Since the Federal On-Scene Coordinator would be from the USCG, a potential exists for confusion concerning the division of responsibility. To minimize possible confusion, the USDOI and USDOT initially established an MOU in August 1971 to outline the USGS's and the USCG's respective responsibilities in responding to a spill from an offshore drilling or production facility. This MOU has been updated several times. The most recent version between MMS and USCG was signed in December 1998. (See 64 FR 2660-2667, Friday, January 15, 1999.)

2. Industry Oil-Spill Response Plans

The basic requirements for OSRPs are specified in MMS operating regulations under 30 CFR 254. The RP's (lessees or operators) must submit for MMS approval an OSRP that covers each facility "located seaward of the coast line" before they may use the facility. A lessee's OSRP must be submitted or referenced with every exploration plan (EP), development and production plan (DPP), or development operations coordination document (DOCD).

The MMS regulations allow any lessee to submit a Regional OSRP that covers all of its operations in one area. If an existing and relevant OSRP is on file with MMS, that OSRP may be referenced in a EP, DPP, or DOCD. Regional response plans must address all the elements required for a response plan in 30 CFR 254, Subpart B, "Oil Spill Response Plans for Outer Continental Shelf Facilities," or Subpart D, "Oil Spill Response Requirements for Facilities Located in State Waters Seaward of the Coast Line," as appropriate.

a. Basic Requirements for OSRP's

When developing a Regional Response Plan, RP's must group leases or facilities covered by the plan for the purposes of calculating response times, determining quantities of response equipment, and conducting oil-spill trajectory analyses. The MMS Regional Supervisor for Field Operations has approval authority over the plans and may specify how to address various elements of a Regional Response Plan and, if necessary, require that the plan contain additional information to fully comply with regulations.

The RP's may reference information contained in other readily accessible documents in their response plans. For example, such documents may include the NCP, an ACP, MMS environmental documents, and Oil-Spill Removal Organization (OSRO) documents. The OSRO's are entities contracted by an owner or operator to provide spill-response equipment or qualified personnel in the event of an oil or hazardous substance spill. The RP's must ensure that the Regional Supervisor is provided with copies of all referenced OSRO documents.

In every OSRP, the lessee or designated operator, as the RP, must:

- Identify a qualified individual (QI) and require immediate communication between that person and appropriate Federal officials and response teams in the event of a spill.
- Designate, by name or position, a trained spill management team available on a 24-hour basis. The team must include a trained spill-response coordinator and alternates who have the responsibility and authority to direct and coordinate response operations on the RP's behalf. The OSRP must describe the team's organizational structure as well as the responsibilities and authorities of each position on the team.
- Identify a spill-response operating team, trained and available on a 24-hour basis, to deploy and operate spill-response equipment. The team must be able to respond within a reasonable minimum specified time. The number and types of personnel available from each identified labor source must be included.
- Designate a planned location for a spill-response operations center and provisions for primary and alternate communications systems available for use in coordinating and directing spill-response operations. All relevant telephone numbers, facsimile numbers, and radio frequencies must be provided.
- List the types and characteristics of the oil handled, stored, or transported at the facility.
- Describe procedures for the early detection of a spill.
- Describe provisions for disposal of recovered oil, oil-contaminated material, and other oily wastes.
- Describe provisions for monitoring and predicting spill movement.
- Identify procedures to be followed in the event of a spill or a substantial threat of a spill. Show response levels for various-sized spills, including those involving fire or explosion.
- Describe the training, equipment testing, unannounced drills, and actions of facility personnel.
- Describe procedures to be used to periodically update and resubmit the plan for approval of each significant change.

Owners or operators of facilities located in State waters seaward of the coastline also must submit a spill-response plan to MMS for approval. They may choose one of three methods to comply: (1) modify an existing OCS response plan covering a lease or facility on the OCS to include a lease or facility in State waters; (2) follow a format for an OCS response plan; or (3) submit an OSRP developed under State requirements. If RP's submit an OSRP developed under State requirements, they must provide documentation concerning State regulations and the State agency to which the plan was submitted.

b. Specific Procedures To Be Described in an OSRP

An OSRP must contain details on the following methods and procedures that the RP (lessee or operator) intends to follow in the event of a spill:

- Methods to monitor and predict spill movement;
- Methods to identify and prioritize the beaches, waterfowl, other marine and shoreline resources, and areas of special economic and environmental importance;
- Methods to protect beaches, waterfowl, other marine and shoreline resources, and areas of special economic or environmental importance;
- Methods to ensure that containment and recovery equipment, as well as the response personnel, are mobilized and deployed at the spill site;
- Methods to ensure that devices for the storage of recovered oil are sufficient to allow recovery operations to continue without interruption;
- Procedures to remove oil and oiled debris from shallow waters and along shorelines and to rehabilitate waterfowl which become oiled;
- Procedures to store, transfer, and dispose of recovered oil and oil-contaminated materials and to ensure that all disposal is in accordance with Federal, State, and local requirements; and
- Methods to implement a dispersant use plan and an in situ burning plan.

c. Plans for a "Worst-Case Discharge Scenario"

According to 30 CFR 254, RP's must calculate the volume of oil for their worst-case discharge. All OSRP's must include an appendix for a "worst-case discharge scenario" that includes: (1) the volume of the RP's worst-case discharge estimation, with assumptions and supporting calculations; (2) a trajectory analysis for the specific facility that identifies all potentially affected areas; (3) a list of the resources of special economic or environmental importance that potentially could be affected, as indicated by the trajectory analysis; and (4) a discussion of the RP's response to a worst-case discharge scenario in adverse weather conditions.

d. Dispersant Use Plan

The OSRP's must include a dispersant use plan that must be consistent with the NCP Product Schedule, other provisions of the NCP, and appropriate ACP's. The plan must include: (1) an inventory, by location, of the dispersants and other chemical or biological products which the RP might use on the oils handled, stored, or transported at the facility; (2) a summary of toxicity data for these products and an outline of the procedures the RP must follow to obtain approval to use these products; and (3) a discussion of the application procedures, the location and type of any application equipment required, and estimate of the time to commence application after approval is obtained.

e. In Situ Burning Plan

The OSRP's must include provisions for igniting an uncontrollable oil spill, which would be done only with the approval of the Federal On-Scene Coordinator. In situ burning plans must be consistent with guidelines authorized by the NCP or appropriate ACP's. In situ burning plans must include:

- the specific burn equipment and its availability, location, and owner;
- the RP's guidelines for well control and safety of personnel and property;
- burning procedures, including provisions for ignition;

- environmental effects and the circumstances in which in situ burning may be appropriate; and
- procedures that must be followed to obtain approval for in situ burning, with the RP's guidelines for making the decision to ignite.

f. Spill Reporting Requirements

The RP's must immediately notify the National Response Center (1-800-424-8802) if they observe an oil spill from their facility or any other source, known or unknown. If they observe a spill originating from another facility, they must immediately notify the RP for that facility and the MMS Regional Supervisor.

In the event of a spill of 1 barrel (bbl) or more, the RP's must orally notify the Regional Supervisor without delay. They must send a written followup report to the Regional Supervisor within 15 days after the spill has been stopped. All reports must include the cause, location, volume, and remedial action taken.

Reports of spills of more than 50 bbl must include information on the sea state, meteorological conditions, and the size and appearance of the slick. The Regional Supervisor may require additional information after determining that further analysis of the response is necessary.

3. Inspection and Maintenance of Spill Response Equipment

a. Equipment Inventory and Inspection

Each RP must maintain an inventory of spill-response materials and supplies, services, equipment, and response vessels available locally and regionally. The RP must identify each of its suppliers and provide their locations and telephone numbers.

The RP's must ensure that the equipment listed in their OSRP's is inspected at least monthly and maintained to ensure optimal performance. They must describe their procedures for inspecting and maintaining spill-response equipment and must keep records of the inspections and maintenance activities for at least 2 years. These records must be made available to any authorized MMS representative upon request.

The RP's must calculate the effective daily recovery capacity of equipment identified in their response plans for containing and recovering a worst-case discharge. This involves multiplying the manufacturer's rated throughput capacity over a 24-hour period by 20 percent to take into account the limitations of the recovery operations due to available daylight, sea state, temperature, viscosity, and emulsification of the oil being recovered. The calculated rate is used by the RP's to determine whether they have sufficient recovery capacity to respond to their worst case discharge scenario.

The RP's are responsible for any required testing of equipment performance and for the accuracy of the information submitted. They must conduct any required performance testing of booms or skimmers in accordance with MMS-approved test criteria. The MMS Regional Supervisor may require performance testing of any spill-response equipment listed in a RP's response plan to verify its capabilities.

b. Response Training and Drills

Spill response planning done for OCS oil and gas activities must be effective in assuring that lessees or operators (RP's) are prepared to respond to any spill which may occur from their permitted operations. Many potential problems can be discovered and corrected through requirements for operator-initiated inspection, training, and drills. Potential problems include:

- vessels and equipment designated in a plan being unavailable due to relocation or repairs,
- equipment not being in working order due to lack of use,
- personnel identified in a plan having been reassigned, or
- inadequately trained personnel.

The MMS Regional Supervisors periodically initiate unannounced response drills for simulated spills to test the preparedness of RP's. Regional Supervisors may evaluate the results of the exercises and advise RP's of required changes in the frequency or location of the required exercises, equipment to be deployed and operated, or deployment procedures or strategies.

According to 30 CFR § 254.41, RP's must ensure that members of the spill-response management team receive annual training in directing the deployment and use of response equipment. The management teams include QI's and spill-response coordinators and alternates. Members of spill-response operating teams also must attend hands-on training classes at least annually. Their training includes the deployment and operation of the response equipment they plan to use.

The RP's must keep all training certificates and training attendance records at locations specified in their OSRP's for at least 2 years. All records—including records of services, personnel, and equipment provided by OSRO's or cooperatives—must be made available to any authorized MMS representative upon request.

According to 30 CFR § 254.42, RP's must exercise each entire OSRP at least once every 3 years in triennial exercises. They may satisfy this requirement by conducting separate exercises for individual parts of the plan over the 3-year period. For any exercise required under the triennial exercise requirement, the RP's must inform the Regional Supervisor of the date of any exercise at least 30 days before the exercise. This allows MMS the opportunity to witness any exercises. In satisfying the triennial exercise requirement, an RP must, at a minimum, conduct:

- An annual spill management team tabletop exercise. Tabletop drills are indoor management and communications exercises that simulate overall spill response coordination. The exercise must test the spill management team's organization, communication, and decisionmaking in managing a response. The spill scenario must not be revealed to team members before the exercise starts.
- An annual deployment exercise of spill-response equipment staged at onshore locations. An RP must deploy and operate each type of equipment in each triennial period. However, it is not necessary to deploy and operate each individual piece of equipment during each exercise.
- An annual notification exercise for each facility that is manned on a 24-hour basis. The exercise must test the ability of facility personnel to quickly communicate pertinent information to the QI.
- A semiannual deployment exercise of any response equipment which the MMS Regional Supervisor requires the RP to maintain at the facility or on dedicated vessels. The RP must deploy and operate each type of the maintained equipment at least once each year, but all equipment types need not be deployed during every exercise.

Each exercise must simulate conditions in the area of operations, including seasonal weather variations, to the extent practicable. The exercises must cover a range of scenarios over the 3-year exercise period, simulating responses to large continuous spills, small-volume spills, and the worst case discharge scenario. The MMS will recognize and give credit to the RP for any documented exercise conducted that satisfies some part of the required triennial exercise. The MMS also will give credit for an actual spill response if the RP evaluates the response and generates a proper record.

The RP's must maintain all records of spill-response exercises for the 3-year exercise cycle at the facility or a location designated in the plan. Records showing that OSRO's and oil-spill removal cooperatives have deployed each type of equipment also must be maintained for the 3-year cycle.

4. Occupational Safety and Health Administration (OSHA) Requirements

The NCP, 40 CFR § 300.150, "Worker Health and Safety," requires that oil-spill responders (including OCS lessees and operators) adhere to the training and safety requirements outlined in the U.S. Department of Labor, OSHA, Hazardous Waste Operations and Emergency Response regulations at 29 CFR § 1910.120. The NCP specifically requires that "All governmental agencies and private employers are directly responsible for the health and safety of their own employees."

The OSHA requirements are focused on the safety of spill responders, such as equipment operators and general laborers who have a potential for exposure to a hazardous substance. Employees must not be permitted to participate in or supervise field activities until they have been trained to a level required by their job function and responsibility. Spill responders are required to have 24 hours of initial oil-spill response instruction and 1 day of actual field experience under the direct supervision of trained and experienced supervisor. The OSHA requirements also address those spill responders having a potential for exposure to a hazardous substance at levels exceeding the permissible exposure limit (PEL), which are generally those situations requiring use of a respirator and protective clothing. Responders having a potential for exposure to a hazardous substance at levels exceeding the PEL are required to have 40 hours of initial training off site and 3 days of actual field experience under the direct supervision of trained and experienced supervisor.

Onsite managers and supervisors are required to receive the same amount of training as the equipment operators and general laborers having the potential for exposure to a hazardous substance at levels exceeding the PEL. Onsite managers and supervisors must also have 8 hours of specialized training in hazardous waste management. Eight hours of annual refresher training is required of both general employees and managers.

5. Review and Revision of OSRP's

Each OSRP is reviewed by MMS specialists to ensure that the plan meets regulatory requirements and protects biological and other resources that could be affected by exploration or production operations. In cases of site-specific OSRP's that are submitted to the States for review along with EP's and DPP's, the OSRPs' are reviewed and commented on by USCG and State regulatory agencies. (The EP's and DPP's may reference an existing Regional Response Plan rather than having an attached site-specific OSRP.)

In the Gulf of Mexico Region, Regional Response Plans are reviewed and approved by MMS only. In the Pacific Region, under an MOU with the California Office of Spill Prevention and Response, the State is provided a copy of the OSRP for facilities in Federal waters for review. The USCG is also provided a copy of the OSRP for review, but only the MMS approves these plans.

The review process ensures that the proposed equipment and strategies are appropriate, personnel are adequately trained, and the RP is fully prepared to respond to an oil spill from its facility. It also ensures that an RP's identified response time is reasonable, accurate, and sufficient to protect nearby resources and environmentally sensitive areas. Response times are further reviewed to determine whether they include sufficient time for the procurement of a vessel and for mobilization, loadup, transportation, and deployment of equipment. Based on the results of this review, MMS determines whether the primary oil-spill-response equipment location identified by the operator is appropriate for the subject plan and whether the projected response time allows sufficient containment and cleanup time prior to a spill's potential contact with an environmentally sensitive area.

The RP's must review their response plan at least every 2 years and must submit all resulting modifications to the MMS Regional Supervisor. The Regional Supervisors may require that RP's resubmit their plans if the plans have become outdated or if numerous revisions have made plans difficult to use.

6. Regional Conditions Affecting OCS Oil-Spill Planning and Response

a. Gulf of Mexico OCS Region

Over 90 percent of all OCS oil and gas production has come from the Gulf of Mexico OCS Central Planning Area offshore Louisiana. There are over 4,000 production platforms throughout the Central and Western Gulf of Mexico OCS. Since 1998, the Gulf of Mexico OCS Region has had a program to conduct unscheduled drills of about 20 randomly selected RP's each year. (Before 1998, there were 6 unscheduled drills annually.) The four types of drills developed by the Region include:

- unannounced drills with equipment mobilization only,
- unannounced drills with equipment mobilization and deployment,
- spot tabletop drills, and
- announced tabletop simulations of a large oil spills.

The MMS requires a written report to be submitted within 15 days of the conclusion of each unannounced drill. The MMS witnesses the drills, evaluates the results of these drills, and advises the lessee of any necessary changes in response equipment, procedures, or strategies. In some instances, the MMS issues Incident of Non-Compliance warnings to the RP's.

Although OSRP's for the Gulf of Mexico do not specify response times, the supplemental oil-spill information submitted for EP's, DPP's, and DOCD's provides response times for operations on a particular lease. First response to a drilling-related spill in the Gulf would generally be made using cooperative OSRO equipment. Operators are responsible for supplying their own vessels, cranes, and personnel when using this equipment.

A large number of operators in the Gulf of Mexico propose the use of contract personnel to load and operate OSRO equipment. This typically involves a "no fee" type of contract with one or more of these companies to provide spill response on a 24-hour basis if they are available at the time of a spill. Because these companies are not located in close proximity to all of OSRO equipment bases, the delivery of the contract personnel to a spill base for loadout could increase a projected response time. A 6-hour timeframe to mobilize personnel and equipment is required in some instances.

There is a wide variation in the distances of the leased areas in the Gulf to shorelines that could be affected by a spill. It should be noted, however, that an oil spill over 60 miles from shore would not normally pose an immediate threat to coastlines in the Gulf, primarily for two reasons. First, prevailing winds and currents in the Gulf do not move spills directly toward the shorelines. Second, the greater the distance a facility is from the shore, the greater the time available before a shoreline would be affected, and the greater time available for the generally light Gulf crude oils to be naturally dispersed. Nevertheless, response to a spill should be undertaken as soon as possible with all due concern for safety and practicality.

A study of the projected response times submitted by Gulf of Mexico OCS operators determined that most facilities located more than 60 miles from an onshore equipment base have response times greater than 12 hours. These response times are based on the following:

- an estimated 4 hours for the procurement and mobilization of personnel and a vessel to a base,
- an estimated 2 hours to load the equipment onto the support vessel,
- an estimate that the vessel would travel at 10 mph in open water, and
- an estimated channel run time.

To partially address this problem, OSRO's have equipped several vessels and staged them at offshore locations to reduce the initial response times for certain areas of the Gulf of Mexico.

Many operators have identified vessel procurement as one of the most limiting factors in reducing response times in the Gulf of Mexico. Procurement times of over 12 hours have been projected in some instances. Many operators have planned for a spill equipment base nearer their onshore support base rather than a base closer to their leases to ensure that a vessel could be procured within a reasonable time. Most companies prefer to rely upon vessels they have already contracted with as opposed to attempting to contract or borrow a vessel from another company at the time of a spill. Procurement of large vessels—from 160 to 180 feet in length—also poses a major response problem. Large vessels would be needed to respond to spills in deepwater blocks, and there are a limited number of spill equipment base locations that can accommodate large vessels. These factors could significantly increase an already lengthy response time to a deepwater area.

b. Pacific OCS Region

In the Pacific OCS Region, there are 23 fixed platforms. The MMS Pacific OCS Region has an annual requirement of one unannounced oil-spill drill per facility witnessed by MMS inspectors in addition to the requirement for each operator to conduct semiannual deployment drills. These exercises are designed to involve the primary level of response and activation of the operator's immediate response team. The primary level of response are spill response capabilities located at or near the platform.

The region also conducts one unannounced major oil spill drill at one of the 23 facilities per year. These exercises are designed to involve primary and secondary response levels and the activation of the operator's emergency response team. (Secondary level represents backup response capability identified in an OSRP for a large or continuing spill.)

For a typical spill drill, the MMS representative arrives unannounced at a targeted platform, hands the foreman a written scenario, and observes and records the response. The scenario outlines time, size and cause of the spill. A rough size of the slick is estimated, using the volume and American Petroleum Institute (API) gravity of the spilled oil. Sorbent pads, 18 inches square, are thrown into the ocean to simulate the spill and the direction of the slick drift.

After the platform foreman is satisfied that the cause of the spill is stopped, he activates the on-site response team, and arranges for the deployment of the on-site boom—750 feet or 1,500 feet, depending on the size of the slick—and skimming device. A minimum of three vessels are involved in the containment and cleanup—two to contain the spill and one to do the skimming. During the drill, the foreman notifies all the interested State and Federal agencies, and shows the MMS representative the spill material inventory and the records of previous equipment inspections and drills. The response team's training records are also verified.

For an unannounced major oil-spill drill, in addition to deploying response equipment, the operator is also required to mobilize their spill-response operations center as described in their OSRP. The MMS representatives and invited observers from other Federal, State, and local agencies arrive unannounced at the operations center to initiate and participate in the exercise. At the conclusion of the exercise, personnel from the agencies and the operator participate in a critique of the exercise to provide the operator feed-back for improvement.

Operators in the Pacific Region are required to keep sufficient equipment on or near the platform to enable them to initiate containment activities immediately. For a second level response, equipment at the platform is supplemented by equipment kept onshore and operated by oil-spill cooperatives formed by the lessees and operators. For example, Clean Seas has prestaged equipment located at Morro Bay, Avila Bay, Santa Barbara Harbor, the Carpinteria Yard, and the Ventura/Port Hueneme area. The three major oil-spill cooperatives on the California coast—Clean Bay, Clean Seas, and Clean Coastal Waters—also have at least six dedicated ocean-going vessels with containment and recovery equipment for oil-spill response. They have formally agreed to provide each other response assistance within the boundaries established by State and Federal regulatory authorities. These cooperatives have also been acquiring new equipment to supplement their existing inventories.

If the Federal On-Scene Coordinator so requests, the U.S. Navy and the USCG Pacific Strike Team can provide additional oil-spill response equipment and personnel located at Stockton and at Hamilton Field in Novato, both in northern California. Also, the Marine Spill Response Corporation (MSRC) has established a Southwest Region Response Center at Port Hueneme on the Santa Barbara Channel (see Section 9.b for a more complete discussion of the MSRC). Equipment from this center may be used for response to a spill from OCS exploration and production operations if so directed by the Federal On-Scene Coordinator.

There have been numerous public expressions of concern about oil spills from possible OCS development along the central California coast. Oil-spill risk to the central California coast from OCS operations is low for several reasons. First, there are no OCS operations along the central California coast to create a spill risk, nor are any such operations expected as a consequence of the proposed lease sale schedule. Oil-spill risks to the Central California coast from existing and potential OCS operations more than 100 miles to the south are very low. Thus, there is no need to locate cleanup response equipment for OCS operations along the central California coast.

c. Alaska OCS Region

Because of the remoteness, relatively short drilling season, and other logistical considerations, the MMS Alaska OCS Region does not require unannounced oil-spill response drills for exploration drilling. Unannounced drills may be conducted in the future if production or other long-duration operations exist in the Region.

The Alaska OCS Region requires scheduled oil-spill response drills witnessed by MMS inspectors for all exploratory drilling operations. During these drills, operators deploy onsite spill-response equipment in response to a preplanned scenario approved by the MMS. In addition, each operator is also required to conduct a table top and communications spill-response exercise to demonstrate its ability to implement a major spill response for a blowout. The scenario for this exercise is coordinated with the USCG. The scenario is announced at the time of the exercise, providing an element of surprise for the drill. During the tabletop exercises, spill trajectories are performed; communications and coordination among agencies are tested; plans and strategies are developed to respond to the spill; and logistics for implementing the spill response and for obtaining additional manpower, response equipment, aircraft, and storage barges are verified.

The activity in the Alaska Region varies significantly from year to year and from location to location. Accordingly, the response equipment in place to respond to spills resulting from activity in the Alaska OCS also varies in response to changes in location of activity. The MMS Alaska OCS Region requires any lessee conducting exploratory drilling operations to have an initial onsite spill-recovery capability of at least 1,000 bbl per day and the ability to mobilize additional equipment and personnel for a larger spill, if necessary. Requirements regarding the type, location, and quantity of equipment are based upon estimates of the maximum spill size and trajectory analysis, as presented in the risk analysis of the OSRP.

Two oil-spill response organizations have been established by the petroleum industry for offshore Alaska: Alaska Clean Seas and Cook Inlet Spill Prevention and Response, Inc. In addition, Alyeska Pipeline Service Company maintains a major spill-response organization for its pipeline and marine terminal operations; however, this equipment is dedicated for response to tanker spills in Prince William Sound, so it may not be available for use in the event of a spill from OCS operations. Many operators in Alaska also maintain their own spill-response personnel and equipment for use as the primary spill response for their operations offshore Alaska.

The limited geographic and temporal presence of open water and slow vessel speeds in broken ice preclude timely spill equipment transport by sea. For larger spills exceeding the local response capability, additional equipment is available from a number of sources. The Alaska OCS environment raises a number of oil-spill concerns because of geographic remoteness and the difficulties of responding to oil spills in arctic conditions. The Section 8 discussion of "Oil-Spill Issues Raised by Arctic Oil and Gas Development" in this appendix will discuss in situ burning as a response measure as well as other aspects of potential oil spills in the Arctic environment.

Because of the remoteness of drilling sites from existing support facilities in the Alaska OCS Region, oil-spill response equipment is normally kept onsite. For example, in the Chukchi Sea, oil-spill response equipment has been maintained on a drillship, on a large nearby icebreaker/support ship, or on a designated oil-spill response barge stationed near the drilling site during the drilling season (approximately July to October). For Chukchi Sea operations, only onsite equipment or equipment transported by helicopter from Point Belcher or Barrow could meet deployment guidelines. If carried by helicopter and weather permitting, spill cleanup equipment from Barrow could reach any point in the Chukchi Sea Planning Area within 3 to 6 hours.

In good weather, equipment transported by plane or helicopter from Point Belcher or Barrow could satisfy the equipment deployment criteria set by MMS for 6-, 12-, and 48-hour responses. Additional equipment from Alaska, Canada, or the lower 48 States also could be airlifted to Barrow or Point Belcher to meet the 48-hour guideline. Other slower-arriving equipment would still be useful in a major spill; but the MMS does not consider such equipment in judging whether the OSRP meets the MMS 48-hour response criteria. (Estimated response times from other onshore oil-spill response bases would be as follows: Deadhorse, 3 to 6 hours (by air); Dutch Harbor, 2 weeks (by sea); and Anchorage, 5 to 8 hours (by air).) Cleanup could continue as long as necessary, without any timeframe or deadline. For example, a winter spill in pack ice might require initial onsite response followed by further oil cleanup in late spring or summer when the oil melts out or pools on top of the ice.

Currently, the only exploration or development offshore the North Slope is being conducted in the Beaufort Sea off Prudhoe Bay. Oil-spill response equipment is staged in Prudhoe Bay/Deadhorse at Alaska Clean Seas facilities. These inventories are sufficient for initial response to a worst-case discharge from any of the facilities in the Prudhoe Bay area. Exploratory work is accomplished during the winter months when solid ice conditions are present. Access to the sites can be gained by air or ice roads in relatively short order depending on visibility.

Onshore support facilities for oil-spill response on Beaufort Sea leases are located primarily at Deadhorse. Equipment stored at Deadhorse is capable of meeting the criteria of the 48-hour response time for major spills. Equipment staged in Deadhorse can be mobilized by air or via ice roads in the winter or by vessel during broken-ice and open-water conditions to spill sites within 3 hours depending on the system.

As a result of the 1989 *Exxon Valdez* spill, a number of critics of the OCS leasing program have observed that a tanker spill originating in one portion of the Alaska OCS can affect a wide area. However, there currently is no production or tankering of oil from OCS leases offshore Alaska; nor are there any plans to transport OCS production by tanker in the Beaufort Sea. Northstar production, which will include OCS oil, is expected to begin in late 2001. This oil will be tankered out of Valdez to the west coast and possibly to the Nikiski Refinery in Alaska. Cook Inlet and Prince William Sound have oil-spill response infrastructure to respond to spills from tankers. Before any OCS development activity could be allowed, a DPP and OSRP would have to be submitted, reviewed, and approved. The DPP would have to describe any proposed tanker activity. If tanker activity were proposed in currently undeveloped areas, the OSRP, OSRO, and other response capabilities would be substantially enhanced to respond to tanker spills.

d. Atlantic OCS

The MMS Gulf of Mexico OCS regional office conducts all leasing and resource management functions for the Atlantic OCS area as well as the Gulf of Mexico OCS Region. The Atlantic OCS area is divided into four planning areas along the Atlantic seaboard: North Atlantic, Mid-Atlantic, South Atlantic, and Straits of Florida. Currently, there are no leases off the Atlantic Coast, and no Atlantic lease sales are planned for the proposed 5-Year OCS Oil and Gas Leasing Program.

7. Effectiveness of Oil-Spill Containment and Cleanup Technology

a. Properties and Behavior of Oil

Before oil-spill response plans are developed or approved, it is important to understand the chemistry and physical behavior of the oil and how its characteristics change over time, once the oil is spilled. The physical and chemical properties of spilled oil change rapidly on the water's surface and often distort the reported volume recovered. Viscosity, density, emulsification, and weathering have a direct bearing on oil recovery operations. These properties influence the selection of response equipment and methods applicable for spill cleanup.

Mechanisms of weathering, evaporation, water-in-oil emulsification, dispersion, dissolution, and photo-oxidation need to be better understood to accurately predict spill behavior. The MMS and its research partners have several ongoing projects to improve their understanding of spill behavior. Through joint research, the MMS OSR Program and Environment Canada plan to continue the physical and chemical analysis of different types of crude oils and to continue to develop the Catalog of Crude Oil and Oil Product Properties that is available on Environment Canada's web site. The catalog provides a single, complete database of the physical and chemical properties of more than 425 different crude oils.

The Behavior of Oil Spilled at Sea Project is designed to provide a comprehensive collection and review of data and concepts related to oil-spill behavior. Topics also include the lesser-documented topics of oil on land, on freshwater, and in the ground. This project will combine into one source, the literature on oil-spill behavior and findings from previous joint research. Over 5,500 papers have been collected and initially reviewed to date. The oil-in-ice review has been completed. Work is continuing on preparation of sections on solubility, evaporation, and emulsification.

b. Response Capabilities

Response capabilities have improved in recent years, allowing for improved detection, containment, recovery, and removal of spilled oil. In particular, recent advances in fire-resistant boom technology have made in situ burning a viable response tool. Improvements in other areas of response technology, response strategy, and more stringent standards for response planning and preparedness have also enhanced cleanup capabilities. Various types of oil-spill countermeasures are generally considered to have the following rates of effectiveness for oil removal using current technology:

- booms and skimmers, 10-20 percent;
- dispersants, 30-40 percent; and
- in situ burning, 90-98 percent if burning is started soon after the spill and before the oil emulsifies.

Technological advances may eventually raise these figures. Test protocol standards are necessary so that regulatory authorities such as MMS, USCG, and USEPA can better evaluate the effectiveness of equipment included in industry response plans. In February 1992, MMS published two test protocols, one for evaluating oil-spill skimmers and the other for evaluating oil-spill containment booms. The MMS is working with the American Society for Testing and Materials (ASTM) Committee F-20 on Hazardous Substances and Materials and Oil Response to improve existing test protocols and to develop new protocols for various types of oil-spill response equipment.

Most of this work is being carried out at OHMSETT, the national oil-spill response test facility, located in Leonardo, New Jersey. The OHMSETT facility is available on a reimbursable basis to both the public and private sectors as a research center to test oil-spill containment and cleanup equipment or techniques, remote sensing devices, or to conduct spill response training. Current testing at OHMSETT is funded by the MMS, USCG, U.S. Navy, USEPA, Environment Canada, MSRC, academia, and private industry.

The OHMSETT's main feature is an above-ground concrete tank, measuring 203 meters long by 20 meters wide and 3.4 meters deep, and filled with 9.84 million liters of clear salt water. Through a variety of mechanical, electrical, and chemical systems, the following test parameters can be controlled or measured: sea state (wave height, length, and period), tow speed, meteorological data, water temperature and salinity, volume of oil encountered and recovered by equipment or procedures, oil-to-water ratios, physical characteristics of oil, and behavior of treated oils.

c. Response Times

The spread of an oil slick following an incident makes the response time a critical factor. In some cases, winds, currents, and tides may cause spreading to occur at a very high rate. In other cases, spreading may take place at a far slower rate—currents may be circular in nature and keep a spill localized, or spreading may be in a direction away from sensitive environmental areas. The "appropriate response time" depends on the situation. Nevertheless, the longer it takes for the response team and equipment to get into place, the larger the area they must cover and the more difficult the job they must complete.

As indicated in the Section 6 discussion on "Regional Conditions Affecting OCS Oil-Spill Planning and Response," damage resulting from a spill can be greatly reduced by locating vessels and equipment in advance so that work can be initiated quickly to contain a spill or to place booms to protect environmentally sensitive areas. Responses to initiate containment and cleanup operations should, in all cases, be immediate, taking into consideration the proximity to "target" areas, the degree of sensitivity of those areas, and the length of time it will take prevailing currents to move a spill from the source to those areas.

d. Techniques for Detecting and Monitoring Spilled Oil

Early detection can limit the size of the overall spill as well as shorten the time necessary to initiate a containment and cleanup response. Practical oil-spill detection is still performed by visual observation, which is limited to favorable sea and atmospheric conditions and is inoperable in rain, fog, or darkness.

After several hours, spilled oil is no longer in uniform slicks but may be spread out so that as much as 90 percent of the oil is in 10 percent of the slick. Effective response operations are dependent upon the ability to locate concentrations of oil and to track the movement of oil slicks. Measurement of physical properties (thickness in particular) helps to determine the feasibility of various responses such as mechanical recovery, dispersant applications, and in situ burning

Without accurate and timely thickness information, responders may spend an inordinate amount of time working on thinner and less productive portions of the slick. Modern remote sensing instrumentation can be used to monitor oil on the open ocean during most times and conditions. With knowledge of slick location and movement, response teams can effectively plan cleanup operations. Even though sensor design and electronics are becoming more sophisticated and less expensive, there remains a lack of capability to measure and accurately map the thickness of oil on the water's surface.

Airborne remote sensing packages have been developed using side-looking radar, synthetic aperture radar, infrared and ultraviolet imagers, or false color cameras. However, current airborne remote sensing equipment either is too affected by weather conditions or consistently shows false images that require visual observations to correct. Wind patterns, fresh water, silt, and seaweed all show up as potential slicks. Airborne remote sensing packages cannot yet discriminate between areas of a slick which are thick enough to recover and portions too thin for any reasonable response effort.

The MMS and Environment Canada have initiated research on the measurement of thickness from aircraft so that response teams can direct collection efforts to areas which permit significant recovery. Significant progress has been made on these systems, but more work needs to be done. The MMS and Environment Canada are continuing to work on oil thickness sensor development to accelerate development of a "laser ultrasonic remote sensing of oil thickness" sensor.

During the *Exxon Valdez* response, infrared and ultraviolet systems were used extensively to aid visual observations. These systems, although not usually available to responders, have proved quite effective in monitoring spill movement (although oil-in-water emulsions are sometimes not detected in the infrared). New technology has made infrared cheap and practical, despite its limitations. The MMS OSR Program is continuing to fund research to improve ultraviolet, infrared, and false color sensing systems.

The joint MMS-Environment Canada program has been evaluating the laser flourosensor for measuring spill thickness by remote means. This device apparently can detect oil in broken ice conditions. It can also be used to detect oil in complicated marine environments and on shorelines, land, snow, and ice. It can provide positive identification of hydrocarbons and discriminate between hydrocarbon types. It can also be used to create a geo-referenced, real-time, annotated map that may be faxed or downlinked to oil-spill response teams working in the field.

Satellite-borne sensors, particularly radar, are useful; however their low frequency of overpass and lack of spatial resolution make them of marginal use for spills. Also, satellite technology has resulted in false positive discrimination and resolution problems.

Spill response teams need an improved understanding of the transport of oil as it is driven by winds and currents. Computerized oil-spill trajectory models have been developed for this purpose, and the models are being evaluated by drifter buoy studies. Oil-spill tracking buoys have been investigated and used for a number of years. Current versions use Global Positioning Systems to track movements. Tracking buoys are best suited for marking the initial location of a spill and providing a gross estimate of drift speed and direction. They have limited utility as a tactical spill-tracking tool. The MMS OSR Program is conducting further research to evaluate improved tracking buoys that move with the oil slick.

During several spills, it was noted that oil submerged and then reappeared in surf zones and on beaches. This was evidenced by significant shoreline oiling where there had been no visible oil reported seaward of the surf zone. Currently, there are no countermeasures for submerged oil. However, some believe that fish-finding sonar can be used to track submerged oil and that effective countermeasures can be developed for use before the oil washes ashore. Recent research during oil spills has identified several mechanisms that can cause oil to submerge. One goal of the MMS OSR Program is to develop a state-of-the-art sensor to detect the presence of submerged or neutrally-buoyant oil.

Detection of oil spilled under arctic ice is discussed in Section 8 of this appendix.

e. Mechanical Containment and Cleanup Equipment

In 1999, the USCG analyzed 231 oil spills greater than 1,000 gallons from their Marine Safety Information System (MSIS) for the period 1993-1998 ("Response Plan Equipment Caps Review: Are Changes to Current Mechanical Recovery, Dispersant, and *In Situ* Burn Equipment Requirements Practicable?" (Caps Review)). Their analysis indicated that on-water mechanical recovery was a viable response option in 62 percent of all nearshore, offshore and open-water spills. A wide variety of mechanical equipment is available for the containment and cleanup of spilled oil, including booms, skimmers, pumps, and sorbents.

Containment of an oil spill is the process of preventing its spread by confining the oil to the area where it has been discharged. Containment not only localizes the spill but also facilitates its removal by causing it to concentrate in thicker layers on the water's surface. Containment booms are generally the first equipment mobilized at the scene of a spill and the last to be removed.

Following containment, the next step in the cleanup operation is physical recovery of the oil from the water’s surface. Three distinct approaches to physical recovery involve mechanical skimmers, sorbents, and manual labor. In most instances, the containment and recovery phases of an oil spill proceed simultaneously.

According to the 1999 USCG Caps Review, mechanical recovery generally results in recovering no more than 20 to 30 percent of spilled oil. Mechanical recovery technology is steadily improving for open-water response as newer designs for containment and recovery systems are refined and operationally tested. However, this technology remains static and rudimentary for ice and fast currents.

Booms: Oil-spill control booms are floating barriers designed to contain and divert spilled oil for recovery. They are also used to protect areas containing commercially valuable or environmentally sensitive resources from oil contamination. A boom is typically constructed of modern materials having a high strength-to-weight ratio and packaged compactly to allow ease in transportation and deployment.

All booms generally incorporate the following features: freeboard to prevent or reduce splashover; subsurface skirt to prevent or reduce the escape of oil under the boom; flotation by air or a buoyant material; and a longitudinal tension member (chain or wire) to withstand the effects of winds, waves, and currents.

The length and size of boom sections are important considerations. The optimum size of a boom is largely related to the sea state under which it is to be used. As a general rule, the minimum height of freeboard to prevent oil splashover should be selected; and the depth of the skirt should be of similar dimensions. Short section lengths of boom are easier to handle and can protect the integrity of the boom as a whole, should one section fail. However, this should be weighed against the difficulty of effectively connecting the sections.

In 1986, the ASTM Subcommittee F20.11 developed a standard for boom connectors. The purpose of the standard is to ensure that booms from different sources will fit together regardless of how or from what materials the connectors are made. The ASTM revised the standard in June 1994.

According to the 1999 USCG Caps Review, the rate at which oil can be collected and contained offshore depends upon the rate of speed through a slick, generally 1 knot or less, and the sweep width of the boom and skimmer combination. (The sweep width is also referred to as the gap width or mouth opening.) Collection rates decrease with increasing sea states. Conventional knowledge indicates that containment booms will not effectively operate in wind speeds over 15 to 20 knots or at tow speeds exceeding 1/2 to 3/4 knots. The USCG Caps Review notes that collecting and concentrating oil in fast currents is difficult and "often impractical at speeds above 3 knots."

Waves heights of 4 feet to 8 feet generally represent the upper limits of boom effectiveness, and response personnel would be placed at very high risk in wave heights even approaching 8 feet. Yet these waves heights are often exceeded on the OCS. (Historically, conventional offshore containment booms usually become ineffective in waves greater than 5 feet; but at least one manufacturer claims to have a boom that has been effectively tested in seas ranging to nearly 10 feet.)

Currently, there are more than 30 different designs of booms in use on the OCS. The relative capabilities of these booms have not been properly quantified through standardized testing techniques or protocols. In April 1994, a series of tests at sea for oil containment booms were conducted jointly by the USCG, MSRC, the U.S. Navy, and MMS. These tests were conducted in lower New York Harbor Bay and in the Atlantic Ocean near Sandy Hook, New Jersey. Thirty-seven trials were conducted using four types of boom to test various aspects of operational failure. The tests indicated that recorded forces on booms are often much stronger than predicted by equations, especially in higher waves and at high tow speeds. In the large-capacity booms, water was found to accumulate inside the boom so that the freeboard inside the boom was less than the freeboard behind the boom. This process and high-wave conditions account for the greater and unanticipated stresses on the booms. Booms with a higher buoyancy-to-weight ratios were able to sustain higher tow speeds and performed more effectively in higher wave conditions. Oil thickness increased with tow speeds, so greater skirt drafts were required to prevent losing oil under the boom at higher tow speeds. Also, peak tow forces (snatch loads) caused by irregular tow speeds and waves can cause boom failure.

More recently, fire-resistant booms have been employed for in situ burning of spilled oil. Applications of fire-resistant booms are discussed below in the section on in situ burning.

Skimmers and skimmer systems: Skimmers are mechanical devices designed to collect spilled oil from the water surface without changing it chemically or physically. Skimmers are classified based on their operating principles into the following major groups:

- weir skimmers that provide for gravity drain off of oil;
- vacuum skimmers, similar to weir skimmers but which use a power source to actively remove oil;
- centrifugal skimmers in which a power source creates a vortex to drain off oil;
- submersion skimmers that force the oil below the water level and then use its buoyant properties to collect it; and
- oleophilic skimmers that collect oil on moving oleophilic material (ropes, disks, belts, etc.) and mechanically squeeze or scrape the oil into collection tanks.

The overall efficiency of a skimmer system depends upon the effectiveness of individual components of the system. These include containment (boom systems), recovery of spilled oil (skimmers, sorbents, and pumps), separation of oil/water mixtures, and transportation of the mixture to receptacles. Each type of skimmer is best suited for a particular situation, and no skimmer is effective in all conditions. The efficiency of each model depends on several parameters, including oil thickness, oil viscosity, sea state, and storage capability. For example, in cold water the increased viscosity of heavy oil reduces the effectiveness of many weir skimmers and can prevent effective operation of vacuum systems and pumps. However, oleophilic skimmers and pumps work quite well for high viscosity oils, providing the oil will flow.

Available oil skimmers generally are rated as performing "good" in sea state 1 (significant wave height to 1 foot). In a sea state of 2 (significant wave height to 2.9 feet), performance falls off with the majority of skimmers being rated as "fair." In a sea state of 3 (significant wave height to 4.9 feet), the vast majority of skimmers are rated as "fair" or "poor." Skimmers are needed that are capable of operating in the "good" range in these higher sea states. This would mean that skimmers would pick up a larger percentage of the oil in the area covered by the skimmer and would operate at higher speeds, thus enabling the skimmer to cover a larger area in a given amount of time.

Winds and sea states have significant effects on the performance of oil-spill equipment. In general, maximum wind speeds of 15-20 knots pose the upper limit for dynamic upwind recovery, and effective recovery in sea states of over 3-4 feet is essentially undocumented. The period of the waves is also important. When an increase in winds produces short-period localized seas, the efficiency of containment and cleanup devices decreases because choppy waves tend to swamp or break over the equipment. Large rolling waves or swells have long periods and present fewer problems because the equipment can follow the waves' contours.

According to the 1999 USCG Caps Review, several skimming systems (Marco Voss 19, JBF 3003, Lori Brusk Pack, and Webster Barnes HIB 20) were tested at OHMSETT in 1996 and achieved recovery rates of between 40 and 236 gallons per minute at tow speeds of 3 knots. These systems could be configured with a V-shaped fast-water boom to produce a capable fast-water oil recovery system. The Caps Review notes, however, that most high-speed skimmers start losing throughput efficiency at speeds above 3 knots and as wave heights increase. Additional testing should be done to verify the effectiveness of various skimming systems, especially those systems which claim effective recovery in sea states over 3 or 4 feet.

The USCG Caps Review concluded that the overall recovery of skimmers has not improved much since 1993; however, the integration of new skimmers with various boom configurations has improved skimmer performance in faster currents. Recent design efforts for containment booms and skimmers have focused on higher tow speeds because 69 percent of oil transported on U.S. waterways is in currents that routinely exceed 1 knot.

Recent research and development efforts have involved the integration of higher-speed containment booms with skimmers to form more capable Vessel of Opportunity Skimming Systems (VOSS's). The VOSS's are deployed from single, independent vessels and provide an attractive means of recovering spilled oil offshore. Large sweep systems are advantageous on large, unified slicks; however, a VOSS unit can be deployed more quickly, is more maneuverable (for skimming windrows of oil, for example), and usually requires only one vessel. The VOSS units allow vessels designed primarily for other purposes to be quickly converted for oil-spill response purposes. Thus, VOSS units help to reduce some of the problems of equipment and manpower coordination inherent in an oil-spill response. Operations of single-vessel systems are primarily limited by the deployment and retrieval of the skimming system in rough conditions, rather than by boom performance in the waves.

Portable skimmers come in various sizes and capacities, from small, drum-mounted rope mop models with a maximum recovery capacity of 15 to 30 bbl per hour, to large skid-mounted disk skimmers with recovery capacities of 200 bbl or more per hour. Portable systems are commonly located at drilling facilities as immediate spill-response skimmers. They are also stockpiled by cooperatives for use in conjunction with shoreline cleanup and for use in bays or other areas where oil may collect.

Pumps, oil/water separators, and temporary storage devices: Pumps are necessary in all phases of oil-spill cleanup operations, including collecting oil from containment devices and transferring it to a vessel or facility. Pumps are also necessary for separation, reprocessing, storage, or disposal.

The 1999 USCG Caps Review notes that oil/water separators and temporary storage devices often cause bottlenecks in response operations. Government and industry have undertaken a test and development program for oil/water separators and temporary storage devices. This has led to development of several lightweight and compact oil/water separator prototypes that are capable of handling up to 250 gallons per minute. Also, a "second generation" of temporary storage devices has been developed, and the new devices are commercially available.

The USCG Caps Review reports that some progress has been made to develop efficient portable oil/water separators that can remove water from skimmer effluents on scene. This makes it possible to transfer recovered oil to storage tanks or facilities. According to the Caps Review, there have also been improvements in temporary storage devices:

> Extensive at-sea and OHMSETT [sic] testing was performed on two state-of-the-art temporary storage devices: Canflex Towable Bladder and Lancer Barge. Both have proven successful and are being integrated into spill response inventories in the private sector. U.S. Navy Supervisor of Salvage (SUPSALV) and MSRC also have performed extensive testing of the Dunlop Dracones (oil bladders) and the Engineered Fabrics oil bladder.

Sorbents: Sorbents are those materials that recover oil either by absorption or adsorption. In absorption, oil penetrates the solid structure of the absorbent material's fibers or particles, which then swell in size to accommodate the oil. In adsorption, oil adheres to the surface of the adsorbent material but does not penetrate the fibers or the particles themselves. Sorbent materials are generally classified by their composition: (1) natural organic products, such as hay, peat moss, straw, or wood pulp; (2) mineral compounds, such as ash, perlite, or vermiculite; (3) synthetic products, such as polyethylene, polypropylene, or polystyrene. Sorbents are usually marketed in particulate form as booms, pillows, rolls, or sheets. Synthetic products are generally preferred over natural sorbents because they are able to remove more oil while taking on less water. For this reason, they take up less storage space and pose less of a disposal problem.

Procedures have been developed to test and evaluate the performance of sorbents. The ASTM has established a test protocol, ASTM F726-99 Standard Method for Testing Sorbent Performance, now available on Environment Canada's Internet web site. A searchable, Internet database has been developed to incorporate test results. New sorbent products continue to appear on the marketplace. There may be differences in the performance that depend on the way the sorbent is prepared or packaged. Through a joint project agreement with Science Applications International Corporation-Canada (SAIC-Canada), U.S. manufacturers that have their sorbent product tested at OHMSETT, will have the option of having their sorbent product tested and evaluated to the ASTM F726-99 Standard Method for Testing Sorbent Performance at no cost. The results of these tests would be reported in the sorbent database, maintained by SAIC-Canada.

f. In Situ Burning

In situ burning has been demonstrated to be a very effective response tool in open-water conditions when used in conjunction with a fire-resistant boom to confine oil slicks and maintain adequate slick thickness to sustain burning. Test results indicate that in situ burning should be a primary technique for major oil spills that occur during broken-ice conditions and for oil trapped under and within the ice. The 1999 USCG Caps Review recognizes in situ burning as "the only effective countermeasure for broken ice conditions. Recovery on solid ice is possible, but again in situ burning is preferred." The MMS believes that in situ burning is an important response measure for offshore spills, regardless of whether broken ice conditions exist.

In situ burning is a highly effective response measure, provided that the oil is not highly emulsified and the burning is conducted within the first few days of the spill. Generally, oil must be relatively fresh and at least 3 millimeters thick on the water surface to sustain burning. Therefore, it is important to capture and concentrate the oil quickly using booms. Because in situ burning is so effective at removing oil, it greatly reduces the need for recovery, storage, transportation, and disposal of spilled oil.

In their 1999 Caps Review analysis of 231 oil spills greater than 1,000 gallons (MSIS, 1993-1998), the USCG found that in situ burning was a viable response option in 24 percent of all nearshore, offshore, and open-water spills. For each of those cases in which in situ burning was not deemed a viable response option, the USCG gave at least one of three possible reasons: (1) the oil discharged could not be ignited; (2) the spill occurred less than 3 nautical miles from shore; or (3) the wind speed exceeded 16 knots.

The Caps Review noted that a test burn during the 1989 *Exxon Valdez* spill began to rapidly change perceptions about in situ burning as a primary spill response measure. The test burn used 3M fire resistant boom and was conducted 2 days following the spill. In this test, an estimated 15,000 to 30,000 gallons of North Slope crude oil were burned in approximately 75 minutes with an estimated efficiency of 98 percent (percentage of oil removed from the water surface). The volume elimination rate for this test using a single 500-foot boom was estimated to be between 350 and 500 gallons per minute (500-1,000 bbl per hour) (Allen, 1990).

In 1993, the MMS, USCG, Canadian Coast Guard, and Environment Canada also co-sponsored a large-scale in situ test burn off the coast of Newfoundland, Canada, now referred to as the Newfoundland Offshore Burn Experiment. This experiment demonstrated in situ burn efficiencies of over 90 percent. It helped allay many of the concerns about air pollution from in situ burning and confirmed the validity of in situ burn as an effective response measure.

The USCG Caps Review reports that as a result of the *Exxon Valdez* and Newfoundland tests, in situ burning has become a widely accepted response measure for offshore spills. There is a growing acceptance of in situ burning as a standard countermeasure, and many RRT’s and Area Committees are incorporating it into their protocols and OSRP’s. However, there is probably a need to demonstrate the success of in situ burning during more actual spill responses before more On-Scene Coordinators are fully confident in proceeding with in situ burning as a primary spill response measure.

Successful in situ burning depends on vaporizing oil and raising its temperature for oxygen to react in a combustion process. The temperature at which vaporization occurs and the combustion process begins varies according to the physical and chemical properties of the crude oil being burned. Once initiated, the combustion reaction produces enough heat to continue vaporizing the oil. For most fresh oils, once a slick is burning it will continue to burn until the slick becomes too thin to sustain burning. The water below the oil slick acts as a heat sink that constantly draws heat away from the oil slick. When the temperature of the oil drops to where it is no longer being vaporized, the combustion reaction ends. Some oil residue remains in the water from all burns.

The Caps Review reports that "ignition of an oil slick is a straightforward procedure with devices and systems already developed and available." For ignition of spills contained in fire-resistant booms, simple floating igniters can be allowed to drift into the oil. The current preferred ignition system is the Helitorch system, which is slung from a helicopter and provides even burning of a gelled fuel mixture. The mixture is ignited by an electric filament and propane jet ignition system. The Helitorch system is flown at a speed of about 40-50 kilometers per hour and at an altitude of from 8 to 23 meters. For emulsified oils, emulsion breakers can be added to the fuel mixture to allow ignition of the oil.

Early ignition of the oil slick is important, because many crudes contain volatile light ends that enable combustion to begin below 50 °C (122 °F). As the oil weathers, the more volatile light ends are lost. This concentrates the more stable heavy ends and raises the ignition temperature. If the oil is spread thin or emulsified, it may be difficult or impossible to conduct effective in situ burning operations.

Some critics of in situ burning have raised questions about the effects of air pollution resulting from the process. Between October 26 and November 10, 1992, the MMS, Environment Canada, and the API conducted six mesoscale burn tests and two evaporation tests to better quantify air quality data related to in situ burn processes. The data from the mesoscale experiments indicated that burn products reach safe levels within several kilometers of the burn site and that the eventual concentrations of particulates and associated pollutants are several orders of magnitude below acutely toxic levels. Nevertheless, in situ burning can present health hazards to response workers carrying out burning and other response operations downwind. Therefore, all response workers should be well equipped with appropriate respirators and protective clothing when in situ burn operations are underway. Workers also should be rotated and their respirators frequently checked to limit their exposure time to health hazards.

Fire-resistant booms: Manufacturers of fire-resistant booms are using various techniques to improve the longevity of booms, either through new materials or through new technology to allow for heat transfer between the inside of the boom and the water beneath the boom. Tests conducted by Oil Stop Inc. showed that fire temperatures reach 2,000 °F (1,093 °C) and water temperatures reach 212 °F (100 °C). External boom temperatures reach 1,700-1,800 °F (927-982 °C) (Schulze, Keith, and Purcell, 1995).

Other research on fire-resistant booms indicates that there are still problems with boom durability for multiple burns. Also, the sea-keeping ability of fire-resistant booms in seas greater than 3 feet remains a problem. Government development efforts focus on developing protocols for design testing to document performance and to encourage further industry efforts to improve design.

The 1999 USCG Caps Review explained that at-sea fire-resistance testing for booms involving oil release and burning is expensive and difficult to arrange. For that reason, NIST designed several techniques for testing booms in tanks that permit exposure to flame, mechanical stress, and wave action in controlled settings. During 1996-1998, tests were conducted in test tanks at the USCG Marine Fire and Safety Test Detachment in Mobile, Alabama, and the Canadian Hydraulic Centre in Ottowa, Ontario. The test procedures conformed to a draft standard test guideline, "Standard Guide for In Situ Burning of Oil Spills on Water: Fire-Resistant Boom," developed by the ASTM F-20 Committee (unpublished draft under ASTM consideration). The draft standard prescribes boom tests using a burn exposure and cool-down cycle sequence of 1 hour of burning, followed by 1 hour with no burning, 1 hour burning, 1 hour with no burning, and finally 1 hour of burning. The booms are subjected to wave action for the entire test. The draft standard also specifies wave characteristics and burn intensity. The USCG represents the draft standard as a major step forward in the documentation of fire-resistant boom development and performance.

The Caps Review concluded that the performance of fire-resistant boom is improving steadily, although the booms are not as seaworthy as standard open-water booms. Service life in actual burn operations is estimated at 6-10 hours. Advanced designs such as the stainless-steel pocket boom and the water-cooled boom have been developed and tested. The USCG hopes that they may eventually provide service life for extended burn operations of from 1 to several days.

The USCG 1999 Caps Review reports that in situ burning is now preauthorized, except as stipulated, from 1 to 9 nautical miles from shore in all U.S. regions except Region I, New England, and

Region IX, California. Under preauthorization, in situ burn is at the discretion of the Federal On-Scene Coordinator without further approval of other Federal or State authorities. Preauthorization zones are limited by geographic area, distance from shore, water depth, and season. Preauthorizations are also limited to the first 4-8 hours of burning, after which the On-Scene Coordinator must inform the RRT of progress and obtain an extension of approval to continue burning. The USCG anticipates that in situ burning is most likely to be used in open coastal locations and offshore, particularly in two Regions—Alaska and the Gulf Coast (Region VI).

The USCG Caps Review reports that under favorable spill conditions, a 500-foot section of boom can be used to burn 5,000 bbl of oil per day. Based on the USCG analysis, there is significant in situ burn oil removal capability in place throughout the country. The USCG notes: "Because of the inherent transportability of fire-resistant boom sections and Helitorch systems, resources can be easily moved from one region to another and quickly deployed."

g. Chemical Treating Agents Including Dispersants

There are a variety of chemical agents that can be applied to spilled oil to facilitate its cleanup or removal from the water's surface. Common chemical treating agents include dispersants, surface washing agents, solidifiers, emulsion breakers and biodegradation agents. The USEPA regulates these classes of treating agents and they must pass a series of effectiveness and toxicity tests before being listed.

The most commonly used chemical treating agents are dispersants. These contain chemicals that reduce the surface tension between the oil and water, resulting in the breakup and dispersal of the slick as small droplets throughout the water column. Dispersant use as an oil-spill response option is controversial and always seems less desirable than on-water mechanical recovery. Yet because mechanical recovery generally results in recovering no more than 20-30 percent of spilled oil, dispersants are a necessary component of many OSRPs.

Chemical dispersion does not remove the oil from the environment. It breaks up the oil allowing it to be mixed with the underlying water. Dispersed oil ultimately will be biodegraded, taken up by marine organisms, or incorporated into bottom sediments. Dispersants cannot be applied without approval in accordance with the NCP (40 CFR 300).

The 1999 USCG Caps Review analysis (MSIS, 1993-1998) indicated that dispersants were a viable response option in 45 percent of the spills. They were also a viable response for 21 percent of spills that occurred more that 3 nautical miles from shore.

Dispersants can be an important tool in spill response when it becomes critical to prevent oil from reaching a sensitive resource, such as a coral reef, marsh area, or wildlife sanctuary. These situations justify the intentional dispersion into the water column as a trade-off to prevent greater damage to other resources. Recent research concludes that concerns over the adverse ecological effects in the water column often have been overstated, and that exposure to dispersed oil was unlikely to be an issue except in shallow-water habitats with restricted circulation. Even then, the benefits of shoreline protection could well outweigh potential adverse effects. With respect to effectiveness, there is not enough field evidence to confirm high efficiencies in actual spill-response operations.

As in the case of in situ burning, any decision to use dispersants must be made soon after a spill occurs. This is because weathering of oil will increase oil viscosity and decrease the capability of chemicals to disperse the oil. According to the USCG Caps Review, when some oils weather and undergo turbulent mixing, they accumulate and retain water droplets in the oil phase. This produces a mousse emulsion, which can contain as much as 75-percent water. If treated oil is dispersed quickly, then emulsion will not form. Less oil will contact the shoreline and damage the environment. However, if oil emulsifies before treatment with dispersants, increased viscosity may severely limit the effectiveness of dispersants. If this happens, a major window of opportunity has been lost. According to the Caps Review, the window of opportunity for dispersant use in most spills ranges from several hours to perhaps a day, depending on the oil.

Factors to be considered in making a decision to use dispersants include oil type and properties, environmental conditions, the availability of dispersant and application equipment, and the probable fate of oil without the treatment. Highly viscous oils, oils with pour points near or above ambient temperature, and oils with a high wax or asphaltene content may not be amenable to dispersant treatment at all.

Dispersant formulations have changed in recent years in attempts to develop more effective and less toxic products. The development of dispersant technology has continued at a steady pace since so-called second-generation dispersants were introduced in the late 1970s. The key components of chemical dispersants are surface-active agents (surfactants), which are molecules that have both water-soluble (hydrophilic) and oil-soluble (hydrophobic) ends. These molecules, when applied to an oil spill, orient themselves at the oil-water interface such that the hydrophilic ends of the molecules are in the water, and the hydrophobic ends are in the oil. The result is a reduction of interfacial tension between the oil and water. This action reduces the cohesiveness of the oil slick, and with wave action, finely dispersed oil droplets are formed in the near-surface water. The hydrophilic surfactant groups prevent droplets from recoalescing.

Dispersants may be applied by boat or aircraft. Boat application is limited to small spills or those within a few miles of shore. Aerial spraying is the preferred method because it offers rapid response, coverage of large areas in a short time, good control of treatment rates, optimum use of dispersants, and much better evaluation of treatment results than is possible from boats. Regardless of the method used, dispersants are generally applied only on oil slicks that are 0.25 millimeters thick or less (a 0.25-mm thick slick contains over 4,000 bbl of oil per square mile).

The dispersant must penetrate the oil to reach the oil-water interface. The proper dosage of dispersant must be used to attain the maximum reduction of interfacial tension. (About 3,200 gallons per square mile [or 5 gallons per acre] is an average amount, depending on the dispersant and the oil type). Finally, some form of energy (e.g., wind, wave, or mechanical) must be applied to the oil/water interface to cause the dispersion of oil in the upper part of the water column. Most dispersants are not recommended for use on spills in very calm waters, although newer types of dispersants require very little mixing energy. Some dispersants are formulated for use on marine (saltwater) spills only.

The National Research Council (NRC) of the NAS has addressed the effects of dispersants in its review, "Using Oil Spill Dispersants on the Sea," and made several recommendations regarding future studies. It also recommended that dispersants be considered as a potential first-response option to oil spills, along with other response options. The NRC (1989) addressed two questions about the use of dispersants: (1) Do they do any good? and (2) Do they do any harm?

It is not easy to answer whether dispersants do any good. In a few carefully planned, monitored, and documented field tests and laboratory tests, several dispersants have been shown to be effective, for some oils that were dispersible, in that they removed a major part of the oil from the water surface. However, results in other field tests and accidental spills have shown dispersants to have low effectiveness.

The interaction of various physical and chemical processes involved in oil dispersion are not well understood, and further studies are needed, particularly concerning when dispersants can be used and what the likely environmental consequences will be. There is evidence that dispersants may, in some circumstances, inhibit the effective operation of cleanup systems. For example, the addition of chemical dispersants will generally reduce the adhesive properties of oil. This can adversely affect the use of oleophilic skimmers during cleanup operations.

On the other hand, developing environmentally acceptable methods for use of dispersants could potentially provide a mechanism for dealing with far greater volumes of spilled oil than can be done with mechanical systems and for dealing with oil spills in oceans where sea state precludes use of mechanical devices. This information must be made available to people with authority to make decisions under emergency conditions.

In 1986, the MMS with Environment Canada began to develop standard evaluation protocols for chemical treating agents, including dispersants. These protocols to measure the laboratory effectiveness with various oils have been developed, and over 14,000 evaluations have been conducted.

Concern that chemical dispersants could be harmful to marine life has led to considerable caution in authorizing their use in actual spill situations. Laboratory studies of dispersants currently in use have shown that their acute lethal toxicities are usually lower than crude oils and refined oil products. However, a wide range of sublethal effects of dispersed oil has been observed in the laboratory. These occur in most cases at concentrations comparable to or higher than those expected in the water column during treatment (1 to 10 parts per million), but seldom at concentrations less than those found several hours after treatment of an oil slick (< 1 part per million). The times of exposure in the laboratory (24-96 hours) are much longer than predicted exposures during slick dispersal in the open sea (1-3 hours), and the effects would be expected to be correspondingly less in the field.

Laboratory bioassays have shown that acute toxicity of dispersed oil generally does not reside in the dispersant, but in the more toxic fractions of the oil. Dispersed and untreated oil shows the same acute toxicity. The immediate ecological impact of dispersed oil varies. In open waters, organisms on the surface will be less affected by dispersed oil than by an oil slick, but organisms in the water column, particularly in the upper layers, will experience greater exposure to oil components if the oil is dispersed. In shallow habitats with poor water circulation, benthic organisms will be more immediately affected by dispersed oil. Although some immediate biological effects of dispersed oil may be greater than for untreated oil, long-term effects on most habitats, such as mangroves, are less, and the habitat recovers faster if the oil is dispersed before it reaches the area.

Dispersant use in the Gulf of Mexico has been gaining acceptance by the five Gulf States. These States, along with USEPA, have approval authority regarding the use of dispersants in waters off their shores. The States, by their participation in the RRTs and Dispersant Working Groups (DWGs), have considered relevant data with the goal of approving dispersant use under specified conditions. The USEPA Region VI RRT granted prespill authorization for the use of dispersants to the Federal On-Scene Coordinator in 1991. Beginning in early 1995, they also granted prespill authorization for using dispersants, as defined by the RRT VI Federal On-Scene Coordinator Preapproved Dispersant Use Manual. Under this guidance, dispersants may be applied in offshore waters of Texas and Louisiana that are no less than 10 meters in depth and at least 3 nautical miles from the nearest shoreline. The preapproval granted in designated waters would apply to spills from either facilities or vessels of those owners or operators able to comply with the approved plan.

In the Alaska OCS Region, guidelines for the use of dispersants have been developed for Prince William Sound and Cook Inlet. These guidelines were developed to provide the USCG with "preapproved use" criteria for each specific area, and have been fully endorsed by the Alaska RRT. Other areas off Alaska are being assessed for developing dispersant-use guidelines.

h. Bioremediation

Bioremediation, which is a term for biodegradation, is a technique involving accelerated metabolic breakdown of spilled oil by microbes. This response strategy has routinely resulted in accelerating removal of oil from beaches at a rate of approximately 10 percent over a 1- to 2-year timeframe depending upon temperature. According to the USCG's 1999 Caps Review, bioremediation is generally used only as a "polishing tool" applied to remaining oil residues only after all other cleanup options have been applied.

This technique was used extensively on beaches in Prince William Sound, Alaska, and at sea following the 1990 *Mega Borg* spill in the Gulf of Mexico. Exxon, the State of Alaska, and USEPA are all in general agreement that bioremediation is an effective tool for shoreline cleanup. The USEPA is conducting further research in the laboratory and is interested in developing evaluation procedures for rating performance of various microbial combinations, fertilizers, and fertilizer and microbe combinations.

i. Coastal Cleanup Techniques

When a spill contacts a coastline, several techniques can be used depending on the type and quantity of oil. Other significant factors include the nature of the coast, the depth of oil penetration into sediments, the accessibility and trafficability of the shoreline, and the possible environmental damage to the shoreline by the treatment under consideration.

For many tidal marsh areas, attempts at removal of oil by mechanical means can do more harm than good. The most common response measure for marsh areas is to place protective booms near the entrances of tidal marshes to prevent oil from entering these areas.

Direct suction: The effectiveness of direct suction depends upon thick accumulations of oil and beach type. This technique can be used if oil has pooled in low spots or in areas of poor drainage. Direct suction can be accomplished with pumps, hoses, and storage containers. Recovered oil can be stored in metal storage containers, natural depressions lined with an impervious material, or vacuum trucks equipped with pumps. Direct suction also can be applied to spills in porous soils such as sand or silt. A trench can be cut into the soil for oil collection so that hoses and pumps can be applied.

Manual removal: Manual removal is preferred for cases in which oil contamination is low or sporadic, or where penetration of oil into the soil has been limited. Therefore, it should not be used for marshes and tidally flooded mud flats. Manual recovery involves use of hand tools such as rakes, shovels, buckets, pickaxes, brush cutters, scythes, and power tools. Oil-contaminated material is collected and put into heavy-duty plastic or burlap bags for disposal.

Due to logistical constraints or to access constraints placed on heavy equipment in some areas, manual recovery may be the only cleanup technique possible for some shoreline spills. This type of response permits selective removal of contaminated sediment and vegetation. However, it is inefficient and labor intensive. The effectiveness of a manual response is directly related to the amount of time, labor, and money that can be committed.

Sorbents: Sorbents provide an effective recovery option for smaller spills, spills in confined areas, and shoreline protection. Sorbent pads, booms, or rolls are often used as part of a manual response, or they can be used in conjunction with other techniques. Once the sorbent materials have become soaked with oil, they can be removed manually or they may be burned.

Heavy equipment: Use of heavy equipment requires either the availability of roads or a means of air-lifting or barging the equipment to contaminated areas. Only certain soil types, such as sand or rocky soil or ice, can support heavy equipment. Graders, scrapers, loaders, bulldozers, and backhoes are types of equipment that may be employed.

Flushing or washing: Flushing or washing operations are extremely labor intensive and may damage the sediment by erosion or by driving oil further into the sediment. Thus, care must be used in employing these techniques. Low-pressure flushing or washing can be used for cleaning light oils, such as fuel oil, from lightly contaminated sediments or vegetation. Water is pumped from the ocean and is flushed over the sediment or vegetation to remove the oil. The flushed oil is trapped downstream or downslope in a manmade trench or in a boomed-off area of the ocean close to shore. The trapped oil may be removed by direct suction, skimming, burning, or sorbent pads. High-pressure flushing may be used for rocky coastlines where there is not much risk of either soil erosion or driving oil deeper into coastal sediments.

Steam cleaning and sandblasting: Steam cleaning and sandblasting are techniques that can be used to remove oil from rocks, boulders, and manmade structures. High-pressure jets of steam or sand are used to physically remove oil from contaminated surfaces. Such high-pressure jets can severely erode sediment or damage uncontaminated flora or fauna if care is not used in their use.

Natural dispersion: Natural dispersion is sometimes the only possible alternative for shoreline cleanup when logistics or weather conditions preclude response efforts. Contaminated shorelines adjacent to high-energy ocean environments—particularly sand, gravel, or cobble beaches—can be effectively cleaned by natural dispersion.

8. Oil-Spill Issues Raised by Arctic Oil and Gas Development

a. Concerns About Effectiveness of Oil-Spill Response Technology in Arctic Environments

Industry operators with experience in the arctic have recognized for a number of years that in situ burning is a highly effective measure for cleaning up oil in arctic conditions, particularly in broken ice.

For example, in April 1983, an industry task group representing Amoco Production Company, Exxon Company USA, Shell Oil Company, and Sohio Alaska Petroleum Company published the report, "*Oil Spill Response in the Arctic, An Assessment of Containment, Recovery and Disposal Techniques*" (Amoco Production Company et al., 1983a). This report concluded: "Throughout the literature, in-situ [sic] burning is reported to work with efficiencies of from 75 to 85% for burns of heavy or weathered oil to 99.87% for fresh crude oil inside a fireproof boom."

Later during 1983, the industry task group consulted with the Alaska Department of Natural Resources and the Alaska Department of Environmental Conservation to design field tests to be "performed and evaluated in accordance with criteria developed by the State." Field demonstration tests for in situ burning and other response measures were held during June and July 1983. The field demonstration test for four in situ oil burns in scattered ice demonstrated that:

1) cold waters and ice are beneficial for limiting the initial spread of oil, resulting in equilibrium thicknesses in excess of 0.1 inch;
2) such oil slicks are ignitable using existing techniques, including helicopter deployment of igniters;
3) the oil slicks can be burned, even in scattered ice conditions, with efficiencies of typically 55-85 percent; and
4) the unburned oil and burned oil residue can be recovered using conventional oil sorbent materials.

The field demonstration tests for burning of oil inside a fire containment boom demonstrated that burn efficiencies of 90-95 percent could be attained.

In summary, the field demonstration tests performed and evaluated in accordance with criteria developed by the State of Alaska in June and July 1983 validated the literature findings published by the industry task group in April 1983. The results of the industry field demonstration tests were published in "*Oil Spill Response in the Arctic, Part 2*," in August 1983 (Amoco Production Company et al., 1983b). Several test burns since that time have shown that in situ burning is an effective response measure particularly in broken ice conditions which often exist offshore Alaska. In the earlier section on in situ burning, it was noted that the 1999 USCG Caps Review indicated that in situ burning had become markedly more acceptable as a response measure because of the 1989 *Exxon Valdez* spill demonstration burn and the 1993 Newfoundland Offshore Burn Experiment tests.

Although the results of industry and MMS-funded research has repeatedly demonstrated the effectiveness of in situ burning as a response to arctic oil spills, State and local officials and Area Committees have been reluctant to recognize it as a first response measure in the event of an arctic spill. This is unfortunate, because there is a relatively short window of opportunity for implementing in situ burning operations after a spill. This means that in situ burn operations should be preplanned and preapproved to ensure an adequate and timely response to a spill event. Cooperative international research has shown that potential adverse air pollution effects during in situ burning are almost entirely limited to spill response workers. Response workers can be adequately protected using respirators and protective clothing.

During a 1998 in situ burning conference in New Orleans, Louisiana, an Alaska Clean Seas representative lamented that response planning in Alaskan waters seems too heavily weighted toward mechanical cleanup methods that are less effective and more costly than in situ burn methods. He attributed this attitude to "the public perception that burning is bad, a regulatory bias against in situ burning, and a general lack of comfort on the part of decisionmakers." This speaker noted that the Cook Inlet Citizens' Advisory Council has been a strong supporter of in situ burning as a primary response method in Cook Inlet during broken-ice conditions. He said that the Advisory Council recognized "the limited applicability of mechanical containment and recovery operations in broken ice conditions" (workshop proceedings, "*In Situ Burning of Oil Spills*," New Orleans, Louisiana, November 2-4, 1998, pp. 47-49).

There is further evidence that in situ burning should be considered a primary response measure for the arctic environment, as demonstrated during two recent testing trials for mechanical cleanup operations in Alaskan waters. The trials were conducted in anticipation of the British Petroleum Exploration Alaska (BPXA) Northstar pipeline project becoming operational during the coming year. The trials were required as a condition of the approval for the Northstar OSRP. A primary objective of the trials was to verify that BPXA and Alaska Clean Seas had corrected noted deficiencies from the fall 1999 trials. The BPXA and Alaska Clean Seas were required to have all equipment described in the approved OSRP available and ready for deployment when broken-ice operations were possible.

The first set of trials during July 10-23, 2000, involved the deployment and operation of a spill response barge designated as the "R-19A tactic" in BPXA's OSRP. The tests, conducted in broken-ice conditions, were designed to determine whether the R-19A tactic would be effective and to establish upper operational limits in ice concentrations ranging from 30 to 70 percent coverage of the ocean surface. This included a test of the barge ice deflection system, a large steel grate used to deflect ice from the skimmer, to determine whether the design would standup under broken-ice conditions and protect the skimmer.

The MMS evaluation of the July 2000 trials concluded that BPXA and Alaska Clean Seas demonstrated the capability to mount an oil-spill response in broken-ice conditions. However, the evaluation concluded that current mechanical response capability for broken-ice conditions is overstated in the OSRP for spring ice conditions. The spill response scenarios in the Northstar spill plan had projected response actions in the R-19A tactic configuration in broken-ice conditions up to 70-percent ocean surface coverage. However, the July 2000 trials established an upper operating limit for the R-19A tactic at approximately 30-percent to 50-percent ice coverage, depending on the size of the pieces of ice.

The MMS evaluation concluded that, given this new limit, response plans needed to be changed to reflect these limitations and to identify other means of recovering oil in heavy concentrations of broken ice. The evaluation further noted that "in situ burning as a means of removing oil from the environment, needs to be factored into the decision process when determining if additional equipment is required."

The second set of Northstar trials was held during October 9-11, 2000. The purpose of the fall trials was to deploy and operate spill response equipment in the R-19A tactic barge configuration in various fall ice conditions to determine the tactic's effectiveness and to establish maximum operational limits.

The R-19A tactic configuration consisted of an ice-breaking barge used as the central oil recovery system with two free-floating LORI brush skimmers, 400 feet of containment boom on either side of the barge, and the barge ice deflection system. In addition to the tactic described in the Alaska Clean Seas Technical Manual, BPXA also conducted trials with weir skimmers and 1,500-foot boom segments. Trials were also conducted with the "R-17 tactic" (as designated in BPXA's OSRP), which consisted of a bay boat with a side-mounted LORI skimmer operating independently of the barge skimming system.

The fall freeze-up ice conditions were completely different from the July breakup conditions. The July ice had been very hard and had well-defined shapes that water and oil flowed around as the skimming system advanced through the water. Unlike the ice encountered during the July trials, the fall ice was very soft and consolidated rapidly. This created a solid mass that plugged the gap between the boom, the barge, and the barge ice deflection system. This, in turn, blocked a consistent flow to the skimmer intake.

Alaska Clean Seas used two types of skimmers during these trials, the LORI brush and the Walosep weir. Both skimmers operated continuously while in the water, but their oil recovery ability was extremely limited due to the ice. Because of the ice's slushy consistency, it could not be pushed under the boom or the LORI skimmer once the boom and the skimmer intake became clogged. The only effective means of clearing the boom was to accelerate to speeds greater than 3 knots and thereby flush the apex of the collected ice. The skimmer intakes could only be cleared by physically lifting the skimmers out the water.

The floating LORI skimmers also had been modified so that hot air could be blown into the skimming unit. This was done to heat the collection hopper, warm the oil, and melt the collected slush. At advancement speeds of 0.6 knots, the skimming brushes picked up a minimal amount of ice, which was quickly melted by this system. As the hopper was filled, especially at a rapid rate, the hot air appeared to be of minimal benefit in reducing the volume of slush. However, the pump did not appear to have problems emptying the collection hopper of water and slush.

The Walosep skimmer was most effective in very-light-grease ice conditions when there was sufficient water to wash the ice into the skimmer intake. In heavier ice concentrations, the skimmer quickly became surrounded by the ice and would only pump efficiently when the skimmer was lowered below what would have been the oil-water interface to increase water flow through the skimmer. Operating the skimmer in this manner drastically increased the amount of water recovered relative to the amount of oil. This, in turn, required more on-water storage capacity, more frequent lightering operations, or limiting recovery until the excess water could be decanted and removed from the storage vessel.

The MMS evaluation concluded that oil recovery in freeze-up conditions with the given equipment and tactics was ineffective:

> Ice concentrates rapidly in the boom and around skimmers to effectively choke off recovery of oil that may be present. The individual pieces of equipment selected for recovery operations in freeze-up conditions are capable of physically operating in the environment, but once ice is present, the system as a whole does not work. Spill response tactics for the fall freeze-up conditions need to be revised to recognize the extremely limited potential for mechanical recovery.

This finding indicates that in situ burning should be considered as a primary method of responding to oil spills during fall freeze-up ice conditions in the arctic, not a secondary or backup measure. Use of only mechanical containment and cleanup measures for primary response during fall freeze-up conditions could worsen the adverse effects resulting from a significant spill in arctic conditions. There is a relatively short window of opportunity for implementing successful in situ burning operations after a spill. This means that in situ burn operations should be preplanned and preapproved to ensure an adequate and timely response to a spill event.

b. Concerns About Spilled Oil Becoming Trapped in or Under Ice

The prospect that oil might be spilled on the Arctic OCS and become trapped in or under the ice raises serious concerns as to whether such trapped oil may cause ice to become less stable and create problems for travel across the ice. These concerns have been the subject of numerous field, laboratory, and analytical studies.

The two largest field experiments took place in the Canadian Beaufort Sea in 1974-1975, and 1980 (NORCOR Engineering Research Ltd. [NORCOR], 1975; Dickins and Buist, 1981). The NORCOR project involved eight spills under arctic sea ice involving two different crude oils totaling 330 bbl. The project studied the interaction of the crude oil with the ice. Very thick slicks of crude oil were pumped under the ice sheet in a protected bay in winter. There was no effect on the integrity of the ice sheet through the winter. During the spring, the oil began to appear before the snow melted. It accelerated the melt process such that the oiled area melted away about a week before the surrounding ice sheet rotted out (NORCOR, 1975).

A study sponsored by DOME Petroleum Ltd. and supported by Alaskan Beaufort Sea Oilspill Response Body (Dickins and Buist, 1981) simulated a subsea blowout by injecting compressed air and Prudhoe Bay crude oil under landfast ice. In the second research experiment, the oil slick released under the ice sheet in winter was relatively thin (1 mm). The oil and gas released did not affect the subsequent growth of the ice sheet, nor did the oil's appearance on the ice surface the following spring measurably increase the melting or decay of the sheet compared to the surrounding clean ice covered with melt pools (Dickins and Buist, 1981).

Since crude oils generally are less dense than seawater, oil released into the water column under a floating solid ice cover will rise and gather in pools or lenses at the bottom of the ice sheet. The size of the oil pool or lens is controlled by the amount of oil spilled, the physical properties of the oil, and the shape of the ice. Typical under-ice currents within the barrier islands are unlikely to exceed 0.5 feet/second. As a result, almost all of the oil will contact the ice under surface within a few feet of the center of a release.

Under-ice sea currents in the coastal Beaufort Sea will not spread spilled oil beyond the initial point of contact with the ice under surface. Several studies have determined that with the roughness values typical of undeformed first-year sea ice, the threshold current speed required to initiate and sustain movement of an oil lens or pool along the ice undersurface is approximately 0.7 feet/second. This is significantly faster than the highest currents anticipated in the coastal Beaufort Sea. (Cammaert, 1980; NORCOR, 1975; Rosennegger 1975).

Even large spills (tens of thousands of barrels) of crude oil underneath or on top of solid (or landfast) ice will usually be contained within hundreds of meters from the spill source, depending on under-ice currents and ice roughness. Natural variations in first-year ice thickness provide huge natural "reservoirs" to effectively contain spilled oil underneath the ice within a small area. This implies that any mid-winter spill under ice would be naturally contained within a relatively small area when compared to an identical volume spilled on open water.

For apparently smooth first-year ice, the height variation of the ice under-surface can be considerable. This is caused by irregular snow coverage and wind effects. Any released oil will penetrate into the skeletal layer of growing ice at the bottom, a distance of a few centimeters. Oil will not usually penetrate into a first-year ice sheet. Even under porous multiyear ice, oil does not climb far into the open channels in the ice sheet. In a batch release, new ice will completely encapsulate the oil layer within 18-72 hours depending on the time of year, December to late April (Dickins and Buist, 1981). Oil spilled after May 1 may not become encapsulated due to insufficient ice growth. Extensive studies show almost no effect of oil on ice growth. Oil typically does not weather or biodegrade in ice because it is encased and protected from exposure in the ice (NORCOR, 1975).

After oil has spread under the ice and has been encapsulated, it will remain trapped until about March, at which time a process of vertical migration will begin with the gradual warming of the ice sheet. The rate of vertical migration depends on the degree of brine drainage within the ice (this is a function of internal temperature), oil pool thickness, and oil viscosity. During the period from November to February when the ice sheet is cooling and growing rapidly, there are very few passages for the oil to penetrate. Vertical migration of the oil is limited to several inches of initial penetration through the porous skeletal layer of individual ice crystals at the ice/water interface. The internal ice temperature reaches a minimum in late February.

As ice temperatures gradually increase in March and April, brine trapped between the columnar ice crystals begins to drain out of the ice, leaving vertical channels for the oil to eventually rise to the surface. The first evidence of natural oil appearance on the ice surface can be observed in late May or early June. The rate of oil migration increases rapidly once daily air temperatures remain consistently above freezing.

Natural melting of the ice from the surface down acts as a competing process to expose the encapsulated oil. When surface melting reaches the level where the ice was growing at the time of the spill, the oil is exposed. In most situations of a concentrated thick oil layer in the ice, natural migration will bring most of the oil to the surface before the surface melts down to meet it. Once the oil reaches the ice surface, it lies in melt pools or remains in patches on the melting ice surface after the surface waters have drained. Winds act to herd the oil into thicker layers against the edges of individual pools. Any oil on the ice at final breakup and disintegration of the ice sheet will be released slowly into the water as thin slicks or sheens.

In summary, it is unlikely that spills associated with exploration and development activities in the Alaskan Beaufort Sea would cause the landfast ice to degrade noticeably different from the normal year-to-year variation in the timing of breakup.

c. Concerns About Detecting Oil Spills From Marine Pipelines Under Arctic Ice

The MMS issues rights-of-way for pipelines that cross the Federal OCS. Generally, the MMS is responsible for pipelines upstream of the point where operating responsibility for offshore pipelines transfers from a producing operator to a transporting operator. From that point shoreward, the USDOT's Research and Special Programs Administration, Office of Pipeline Safety, regulates transportation pipelines. The State of Alaska's Pipeline Coordinator's Office issues rights-of-way for pipelines across State submerged lands.

These agencies have similar regulatory requirements that address various aspect of pipeline design, construction, maintenance, repair, inspection, operation, safety, pollution prevention, and environmental protection. They also have enforcement authority to shut down pipelines in the event of regulatory noncompliance or potential problems concerning operational safety.

Generally, computerized leak-detection systems can measure leaks less than 1 percent of the total flow volume. Leak detection systems may be based on measurements of operating pressures, flow rates, or volumetric comparisons of flows entering and leaving the pipeline over a given period, etc. Threshold limits indicating possible leaks are set for the various measuring devices.

For a relatively short and simple pipeline system, the leak detection system can be set at low thresholds to detect leaks quickly. In such a case, response times for detecting a leak and shutting in the pipeline are on the order of minutes, and spill volumes are on the order of a few tens of barrels.

For a larger-volume and more complex pipeline system receiving inputs from several sources, threshold limits must be more widely set to accommodate transient flows as the various sources start up or shut down. Leaks occurring in such systems are more difficult to detect. Below-threshold leak rates of several hundreds of barrels per day could go undetected for several hours or even days.

For leak rates that are less than the threshold, the leak could go undetected until visual inspection or a discrepancy in mass balance between production and sales was identified. Leak rates of several hundreds of barrels per day should be detected from within a few hours to a day or two. To detect leak rates that are less than the threshold, the MMS Regional Supervisor could require that a volumetric line mass balance comparison of line inflows and outflows be conducted at least daily or at several intervals over the course of a day. Such a requirement would ensure that a significant below-threshold leak would be discovered within a matter of hours. In the event of such a leak, the Regional Supervisor would require that the pipeline system be shut down immediately until repairs are completed.

Pinhole leaks, with rates of a few barrels per day or less, possibly could continue undiscovered for extended periods. Systematic inspection through use of instrumented internal inspection devices (smart pigs) should increase the possibility that leak-causing welding flaws, other defects, or corrosion would be detected before any leaks occur.

One method of searching and detecting the presence of oil leaking at low rates from a marine pipeline in the winter period involves drilling holes at frequent intervals along the pipeline route to expose any oil which could be trapped in or under the ice. This method is expensive, labor intensive, and exposes personnel to the vagaries of extreme weather. The MMS OSR Program is funding research to develop state-of-the-art sensor for searching and detecting the presence of oil in and under sea ice.

In a recent development, however, the new British Petroleum Northstar pipeline project is equipped with a leak detection system called LEOS that has not previously been used either in the arctic or for subsea pipelines. Although the LEOS system has not been tried under arctic conditions, MMS is glad that this type of technology is available for use in this project. LEOS is a sensor tube installed parallel to and along the full length of the Northstar pipeline. It is designed to detect hydrocarbon molecules from very small leaks and determine the location of the leak on the pipeline. If successful, LEOS eventually could be considered among the best available and safest technologies applied in OCS operations. Northstar will be the first pipeline system to transport OCS production from Beaufort Sea leases. The Northstar pipelines are pigable and have a Supervisory Control and Data Acquisition system for leak detection. Offshore segments of the pipelines are isolated by valves on the Northstar Island and at the shore crossings.

9. National Response Organizations

a. National Response Corporation (NR Corp.)

The NR Corp. is the largest for-profit oil-spill response organization in the United States. It has primary offices in Great River, New York; New York, New York; Eureka, California; Seattle, Washington; Houston, Texas; San Juan, Puerto Rico; Tampa, Florida; and Memphis, Tennessee. The NR Corp. is designed to provide a single source of trained personnel and specialized equipment for responding to marine oil spills in accordance with Federal and State oil pollution regulations. The NR Corp. holds the highest OSRO classification designated by the USCG, Level E, in rivers and canals and in inland, nearshore, offshore, and open-ocean environments. The NR Corp. provides Level E OSRO coverage throughout the U.S. east coast, the Gulf Coast, the U.S. Caribbean, and the U.S. inland river system.

The NR Corp. enters into retainer agreements to provide spill response resources to companies required to submit OSRP's to Federal and State agencies and is listed in over 2,500 Vessel & Facility Response Plans filed with both the USCG and the USEPA as the plan holders' primary and contractual OSRO. Since its inception, NR Corp. has responded to more than 290 spills on the east coast, Gulf Coast, west coast, Caribbean, and inland river regions of the United States.

The response strategy of the NR Corp. is based upon managing and coordinating a network of contractors—the Independent Contractor Network (ICN). This network provides a base of over 4,200 trained oil-spill response personnel, including supervisors, foremen, and field technicians. The NR Corp. originally selected a group of over 50 contractors based on a thorough audit of their individual resources and capabilities. Approximately 12 of these ICN contractors are located in Texas and Louisiana. The ICN is based at 130 locations nationwide.

The NR Corp.'s strategy grew out of the recognition that 98 percent of all spills are less than 10,000 gallons and have been responded to successfully by an existing group of oil-spill contractors who have been in business for years. Because these contractors employ local personnel, they each possess valuable local knowledge essential to a rapid, effective response during a crisis situation.

The NR Corp.-owned equipment is placed with the individual contractors. The NR Corp. quantified the gap that existed between existing contractors' capabilities as a group and the capabilities required by the USCG for complying with OPA regulations. The NR Corp. then proceeded to augment the contractors' capabilities by purchasing high cost capital equipment that individual oil-spill contractors could not justify purchasing from a practical business point of view. Because of the ICN and NR Corp.-owned equipment, the NR Corp. is able to "cascade" massive numbers of personnel and equipment into a response effort as dictated by clients, their OSRP's, and the spill situation being faced.

The International Operations Center in Great River, New York, functions as the NR Corp.'s focal point for coordinating its response efforts. Satellite, single side-band high frequency, and terrestrial phone, fax, and modem capabilities put key International Operations Center personnel in direct contact with all aspects of the response process. This enables NR Corp. managers to communicate and coordinate directly with clients, contractors, support agencies, response vessels, and NR Corp. field operations personnel.

The offshore component of the ICN is the Marine Resource Network, which serves as a source for backup and support to the dedicated vessels in the NR Corp.'s offshore fleet. For its offshore response capability, the NR Corp. utilizes existing offshore supply vessels which continue to engage in commercial activities when possible. The NR Corp. has converted a fleet of 13 vessels and barges ranging in size from 110 to 275 feet in length and outfitted them with high-capacity skimming systems that can provide per vessel total effective derated skimming capacities ranging from 10,000 to 26,125 bbl per day. The NR Corp.'s fleet of oil-spill recovery vessels are located at the following ports:

- Portland, Maine,
- New York, New York,
- Cape May, New Jersey,
- Norfolk, Virginia,
- Charleston, South Carolina,
- Miami and Tampa, Florida,
- Mobile, Alabama,
- Grand Isle, Louisiana,
- Galveston and Corpus Christi, Texas, and
- San Juan, Puerto Rico.

b. Marine Spill Response Corporation and the Marine Preservation Association

The MSRC and the Marine Preservation Association were established in September 1990 with the goal of making MSRC the world's largest oil-spill cleanup organization. Companies who join the Marine Preservation Association have the right to enter into a contract with the MSRC to be designated cleanup organizations. Funding for MSRC is provided through the Marine Preservation Association, which is a separate organization of owners, shippers, and receivers of oil. The Marine Preservation Association members pay annual dues based on the quantity of oil they transported during the previous year. Both organizations are not-for-profit entities, and each is independent of the other. The MSRC uses Marine Preservation Association grants for MSRC's capital, research, and development costs that are not tied directly to an oil-spill response. The expenses incurred by the MSRC during an oil-spill response are recovered directly from either members who have spilled oil or their insurers. The MSRC may also offer its equipment or services directly to the Federal Government, which reimburses MSRC from the Oil Spill Liability Trust Fund.

The MSRC and the Marine Preservation Association grew out of the efforts of an API task force that was set up immediately following the 1989 *Exxon Valdez* disaster. The task force investigated existing resources for responding to other catastrophic oil spills similar to the *Exxon Valdez*, and concluded that the capability did not exist, either in industry or government, to successfully contain and remove a spill of such magnitude. As a result of the task force recommendations and enactment of the OPA, about 20 oil companies began work on a means of responding to catastrophic oil spills. They agreed upon formation of the MSRC and the Marine Preservation Association.

The MSRC regional centers and prestaging areas are designed to ensure a quick response to a large spill in U.S. coastal and tidal waters, out to the limits of the U.S. 200-mile Exclusive Economic Zone. The MSRC is headquartered in Washington, D.C., and has five regional response centers. Each center has the capability of responding to a spill of up to 200,000 bbl of oil, nearly equal to the *Exxon Valdez* spill. In addition to the regional response centers, each region has from three to six prestaging areas.

The MSRC regional centers and prestaging areas will be located as follows:

MSRC Region	Prestaging Area
Northeast Region I in Edison, New Jersey	Portland, Maine; Boston, Massachusetts; Narragansett Bay, Rhode Island; Delaware Bay, Delaware; Baltimore, Maryland; and Hampton Roads, Virginia
Southeast Region II in Miami, Florida	Wilmington, North Carolina; Savannah, Georgia; Tampa, Florida; Key West, Florida; and in the U.S. Virgin Islands
Gulf Region III in Lake Charles, Louisiana, near the Texas border	Mobile, Alabama; Venice, Louisiana; Galveston, Texas; and Corpus Christi, Texas
Southwest Region IV in Port Hueneme, California, north of Los Angeles on the Santa Barbara Channel	San Diego, California; Richmond, California; Eureka, California; and Oahu, Hawaii
Northwest Region V in Everett, Washington	Bellingham, Washington; Port Angeles, Washington; and Astoria, Oregon

The MSRC, as a matter of policy, will not compete with existing organizations already established for responding to oil spills. The MSRC offers its customers a full range of oil-spill response capabilities intended to help meet the planning criteria of the OPA. This is accomplished through a combination of MSRC's own dedicated response capability and contracted resources, including "shoreline protection and cleanup," "shallow water capability," "average most probable discharge," "maximum most probable discharge," and "worst-case discharge." In recognition of these capabilities, the USCG has classified MSRC under its OSRO guidelines of the “Level A through E” OSRO throughout MSRC's primary operational area.

In addition to being designed for major spills, the MSRC is available to assist with smaller spills whenever the USCG takes over direction of a spill cleanup, determines that local response capabilities are inadequate, and then directs the MSRC to provide assistance. The MSRC is intended to augment rather than replace local spill cooperatives and response contractors. Also, MSRC relies on subcontracts with local spill response organizations to supplement MSRC capability during major spill responses.

The MSRC has about 400 full-time employees and maintains vessels, trucks, booms, skimmers, dispersants, and wildlife and shoreline rehabilitation tools. So far, the MSRC has purchased about $220 million worth of vessels and equipment, including 16 offshore response vessels (OSRV’s). The OSRV’s are the principal recovery vessels for MSRC, with 16 over-the-side high capacity skimmers and boom containment systems. The OSRV’s are approximately 210 feet long, have temporary storage for 4,000 bbl of recovered oil, and have the ability to separate oil and water aboard ship. To enable the OSRV to sustain cleanup operations, recovered oil is transferred into other vessels or barges. Each OSRV is normally equipped with the following standard oil containment and recovery devices: one 32-foot support boat; one Transrec 350 skimmer; one Norwegian Oil Trawl skimmer with 110 meters of boom with bottom nets and 95 meters of guiding boom, and two sections of 660-foot Sea Sentry boom. The skimmers are reported to have a manufacturer's advertised removal capacity of up to 2,200 bbl/hour.

The MSRC is outfitted with other specialized response vessels and support equipment, including:

- 17 oil-spill response barges with storage capacities between 32,000 and 68,000 bbls;
- 68 shallow water barges;
- 331,300 feet of boom;
- over 130 skimmers;
- six mobile communications suites comprising telephone and computer connections, and ultra-high-frequency and very-high-frequency marine, aviation, and business band radios; and
- various small crafts and shallow-water vessels.

The MSRC has a computer-assisted spill management system for spill tracking, identifying resources at risk, and directing logistics in real time. It has also developed a program to audit, on a continuing basis, the readiness of response forces to meet their objectives. The MSRC also funds research programs to study the chemical and biological effects of spilled oil in the environment, techniques for on-water recovery and treatment, and the prevention or mitigation of shoreline impacts.

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APPENDIX D

D. ASSUMED MITIGATION MEASURES

All Minerals Mangement Service (MMS) sale proposals include rules and regulations prescribing environmental controls to be imposed on lease operators. Lease stipulations, Outer Continental Shelf regulations, and other measures provide a regulatory base for implementing environmental protection on leases issued as a result of a sale. The ongoing Environmental Studies Program and analyses directed at activities taking place in a sale area provide information used in the Agency's regulatory control over the life of the leases.

The MMS has broad permitting and monitoring authority to ensure safe operations and environmental protection. Use of the best available and safest technologies during exploration, development, and production and the adopted stipulations are just a few of the measures designed to prevent environmental damage. The MMS also monitors operations after drilling has begun and carries out periodic inspections of facilities (in certain instances, in conjunction with other Federal Agencies such as the U.S. Environmental Protection Agency) to ensure safe and clean operations over the life of the leases.

The analyses in the environmental impact statement assume the implementation of all mitigation measures required by statue or regulation. In addition, the impact analysis assumes that sale-specific stipulations that were commonly adopted in past lease sales are in effect. The following is a brief description of the sale-specific stipulations or other mitigations assumed in the analysis of potential effects of the proposed action.

1. Gulf of Mexico Region

a. Topographic Features

This stipulation designates a "No Activity Zone" around several underwater topographic features commonly called "banks" whose crests may contain biological communities including corals. The No Activity Zone is designed to protect the biota of these features from adverse effects of routine offshore oil and gas activities by preventing the emplacement of platforms, or the anchoring of service vessels or mobile drilling units, directly on the banks and requiring that drilling discharges be shunted in such a manner that they do not settle on the biota.

b. Live Bottom (Pinnacle Trend)

This stipulation is intended to protect the pinnacle trend area and the associated hard-bottom communities from damage from oil and gas activities. If the required live bottom survey report determines that the live bottom may be adversely impacted by the proposed activity, certain measures, such as relocation or monitoring, may be required.

c. Live Bottom (Low Relief)

This stipulation is intended to protect hard-bottom communities not associated with bathymetric features on the sea bottom. Biological communities such as seagrass beds, sponges, and corals may occur on smooth topography. If the required live bottom survey report determines that the live bottom may be adversely impacted by the proposed activity, certain measures, such as relocation or monitoring, may be required.

d. Oil-Spill Response (Eastern Gulf of Mexico)

This stipulation is intended to minimize the risk of oil spills reaching Florida State waters by requiring the staging of state-of-the-art mechanical oil-spill response equipment within specified timeframes and by requiring that oil dispersant chemicals and equipment be maintained in a state of readiness.

e. Military Areas

This stipulation has three sections: hold harmless, electromagnetic emissions, and operational. The hold harmless section serves to protect the U.S. Government from liability in the event of an accident involving a lessee and military activities. The electromagnetic emissions section requires the lessee and its agents to reduce and curtail the use of equipment emitting electromagnetic energy in certain areas. This reduces the impact of offshore oil and gas activities on military communications and missile testing. The operational section requires prior notification of the military when offshore oil and gas activities are scheduled within a military use area to assist in scheduling activities and to prevent potential conflicts.

A second stipulation requires the evacuation, upon the receipt of a directive from the MMS Regional Director, of all personnel from all structures on the lease and the shutting in and securing of all wells and other equipment, including pipelines, on the lease.

Two additional stipulations are applied to leases in the Eastern Gulf of Mexico Planning Area only. In cooperation with the U.S. Air Force, "drilling windows" are established for 6-month periods during which exploratory operations or workover operations may be conducted on leases. This time-sharing arrangement allows military operations to proceed in areas containing leases without being disrupted by oil and gas activities, and without undue disturbance to the exploratory activity and workover operations.

An additional stipulation has been included for the Western Gulf of Mexico Planning Area only. The Naval Mine Warfare Stipulation is intended to eliminate potential impacts from multiple-use conflicts in the Western Planning Area, Mustang Island Area East Addition, Blocks 732, 733, and 734. The U.S. Department of the Navy has identified these blocks as needed for testing equipment and for training mine warfare personnel.

2. Alaska Region

a. Orientation Program

This stipulation is designed to provide increased protection of the environment by promoting an understanding of, and appreciation for, local community values, customs, and lifestyles of Alaskans. It also provides information to industry on the biological resources used for commercial and subsistence purposes, archaeological resources of the area and appropriate ways to protect them, and reducing industrial noise and disturbance effects on marine mammals and marine and coastal birds. The program shall be designed in sufficient detail to inform individuals working on the project of specific types of environmental, social, and cultural concerns that relate to the sale and adjacent areas.

b. Protection of Biological Resources

This stipulation provides a formal mechanism for identifying important or unique biological populations or habitats that may exist in the proposed sale area and require additional protection because of their sensitivity and/or vulnerability. If critical biological resources are identified, the lessee may be required to modify operations to ensure that significant biological populations or habitats deserving protection are not adversely affected. These modifications could include shifts in operational sites, modifications in drilling procedures, and increased consideration of the areas during oil-spill contingency planning.

c. Protection of Fisheries

This stipulation is designed to ensure that the petroleum industry and the participants in commercial and subsistence fishing activities have a mechanism to ensure their activities are coordinated to minimize spatial conflicts. Without safeguards, commercial and subsistence fishing may be subject to interference from offshore oil and gas operations. Lease-related uses will be restricted if restriction is determined necessary to prevent unreasonable conflicts with local subsistence hunts and sport and commercial fishing operations. The stipulation requires the lessee to review planned exploration and development activities (including plans for seismic surveys, drill rig transportation, or other vessel traffic) with potentially affected fishing organizations, subsistence communities, and port authorities to prevent unreasonable fishing gear conflicts. It also provides an opportunity for local communities, including fishing interests, to review and comment to MMS on proposed exploration plans and development and production plans as part of the MMS regulatory review process, which considers such comments prior to any decisions to approve, disapprove, or require modification of such plans.

d. Transportation of Hydrocarbons

This stipulation provides a formal way of selecting a means of transporting petroleum from a sale area. It also informs the lessee that (1) MMS reserves the right to require the placement of pipelines in certain designated management areas, (2) pipelines must be designed and constructed to withstand the hazardous conditions that may be encountered in the sale area, and (3) pipeline construction and associated activities must comply with regulations. This stipulation is intended to ensure that the decision on which method to use in transporting hydrocarbons considers the social, environmental, and economic consequences of pipelines. This stipulation requires the use of pipelines if (1) pipeline rights-of-way can be determined and obtained; (2) laying such pipelines is technologically feasible and environmentally preferable; and (3) in the opinion of the lessor, pipelines can be laid without net social loss, taking into account any incremental costs of pipelines over alternative methods of transportation and any incremental benefits in the form of increased environmental protection or reduced multiple-use conflicts.

e. Industry Site-Specific Bowhead Whale-Monitoring Program

This stipulation requires industry to conduct a site-specific monitoring program to determine when bowhead whales are present in the vicinity of lease operations during exploratory drilling activities, including seismic surveys, and the extent of behavioral effects on bowhead whales due to these activities. It also provides a formal mechanism for the oil and gas industry to coordinate logistics activities with the MMS Bowhead Whale Aerial Survey Project and provide reports of Bowhead whale sightings during monitoring. It is intended to help protect endangered bowhead whales during their migration from significant adverse effects due to exploratory activities. The monitoring plan must provide an opportunity for an Alaska Eskimo Whaling Commission (AEWC) or North Slope Borough (NSB) representative to participate in the monitoring program. No monitoring program will be required if the MMS Alaska Regional Supervisor for Field Operations, in consultation with the NSB and the AEWC, determines that a monitoring program is not necessary based on the size, timing, duration, and scope of the proposed operations. The stipulation ensures participation by the NSB, the AEWC, and the State of Alaska in the design and review of proposed bowhead whale monitoring plans, and the establishment of an independent peer review of the monitoring plans and draft reports.

f. Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities

This stipulation is designed to reduce disturbance effects on Native lifestyles and subsistence practices from oil and gas industry activities by requiring industry to make reasonable efforts to conduct all aspects of their operations in a manner that recognizes Native subsistence requirements and avoids adverse effects on local subsistence harvests and cultural values. It requires industry to conduct all exploration, development, and production activities in a manner that prevents unreasonable conflicts between the oil and gas industry and subsistence activities, especially the subsistence bowhead whale hunt. This stipulation also requires industry to consult with potentially affected Native communities, the NSB and the AEWC to discuss possible siting and timing conflicts and to assure that exploration, development, and production activities do not result in unreasonable conflicts with subsistence whaling and other subsistence harvests. It also provides a mechanism to address unresolved conflicts between the oil and gas industry and subsistence activities. This stipulation provides for restriction of lease-related uses, when necessary, to prevent unreasonable conflicts with local subsistence activities. These might include a seasonal drilling restriction, seismic and threshold depth restriction, and requirements for directional drilling and the use of other technologies.

g. Information to Lessee

A number of Information to Lessee's (ITL's) have been developed to provide specific protection for environmental, social, and cultural concerns. These measures encourage lessees to:

- bring residents of North Slope communities into the planning process; and
- incorporate into their Orientation Programs the Kaktovikmiut and Nuiqsutmiut papers to use as guides to assist in fostering understanding and sensitivity to community values.

Additional ITL's advise lessees of:

- the potential effects of seismic surveys and the specifics of the stipulation on the bowhead whale monitoring program;
- the potential for polar bears to be present in the area of operations, and to conduct activities in a manner which will limit potential encounters and interactions between lease operations and polar bears;
- the review of exploration and development and production plans to ensure that the threatened spectacled and Steller's eiders and their habitats are protected;
- the possible prohibition of shore-based facilities in river deltas that have been identified as special habitats for bird nesting and fish overwintering;
- the possibility that MMS may limit or modify operations if they could result in significant effects on the availability of bowhead whales for subsistence use;
- the U.S. Department of Commerce, National Marine Fisheries Service's review of exploration and development and production plans for activities planned in the spring lead systems of the

bowhead whales to determine whether the planned activities would likely jeopardize the continued existence of the Bowhead whale population;

- the existence of the Arctic Biological Task Force and the consideration of recommendations from this task force in the enforcement of the Protection of Biological Resources Stipulation (see Section D.2.b above);
- the prohibition of exploratory drilling, testing, and other downhole activities in broken-ice conditions unless the lessee can demonstrate the capability to detect, contain, clean up, and dispose of spilled oil in broken ice;
- the fact that disturbance of wildlife could be determined to constitute harm or harassment and thereby be in violation of existing laws and treaties;
- sensitive areas to be considered when developing oil-spill contingency plans to help protect environmentally sensitive areas and their concentrations of marine birds, marine mammals, fishes, and other biological resources;
- the fact that the Steller sea lion is listed as a threatened species and that lessees should conduct their activities in a manner that will limit potential encounters and interactions;
- the fact that oil-spill cleanup plans must be prepared by lessees and approved by MMS prior to approval of exploration and development plans;
- the fact that evidence of oil spill financial responsibility must be established and maintained; and
- the fact that the State of Alaska will review Outer Continental Shelf plans and associated oil-spill contingency plans per consistency review with the Alaska Coastal Zone Management Program.

APPENDIX E

E. FEDERAL LAWS AND EXECUTIVE ORDERS

1. Federal Laws

a. The Outer Continental Shelf Lands Act (OCSLA)

The OCSLA of 1953 authorized the Secretary of the Interior to grant mineral leases and to prescribe regulations governing oil and gas activities on Outer Continental Shelf (OCS) lands. The OCSLA defines the OCS as:

> ". . . all submerged lands lying seaward and outside of the areas lands beneath navigable waters as defined in section 2 of the Submerged Lands Act and of which the subsoil and seabed appertain to the United States and are subject to its jurisdiction and control."

The pertinent provision of the Submerged Lands Act defines "navigable waters" as:

> ". . . all lands permanently or periodically covered by tidal waters up to but not above the line of mean high tide and seaward to a line three geographical miles distant from the coast line of each such State and to the boundary line of each such State where in any case such boundary as it existed at the time such State became a member of the Union, or as heretofore approved by Congress, extends seaward (or into the Gulf of Mexico) beyond three geographical miles . . . . "

Under the OCSLA, the U.S. Department of the Interior (USDOI) is required to:

- manage the orderly leasing, exploration, development, and production of oil and gas resources on the Federal OCS;
- ensure the protection of the human, marine, and coastal environments;
- ensure that the public receives a fair and equitable return for these resources; and
- ensure that free-market competition is maintained.

Within the USDOI, the Minerals Management Service (MMS) is charged with the responsibility of managing and regulating the development of OCS oil and gas resources in accordance with the provisions of the OCSLA. The MMS operating regulations are presented in Chapter 30, Code of Federal Regulations (CFR), Part 250.

b. The National Environment Policy Act (NEPA)

The NEPA of 1969 is the foundation of environmental policymaking in the United States. The NEPA process is intended to help public officials make decisions based on an understanding of environmental consequences and take actions that protect, restore, and enhance the environment. The NEPA established two primary mechanisms for this purpose:

- The Council on Environmental Quality (CEQ) was established to advise Agencies on the environmental decision making process and to oversee and coordinate the development of Federal environmental policy.
- Agencies must include an environmental review process early in the planning for proposed actions.

The CEQ issued regulations in 1978 implementing NEPA. The regulations include procedures to be used by Federal Agencies for the environmental review process. These regulations provide for the use of the NEPA process to identify and assess reasonable alternatives to proposed actions that avoid or minimize adverse effects of these actions upon the quality of the human environment. Scoping is used to identify the scope and significance of important environmental issues associated with a proposed Federal action through coordination with Federal, State, and local agencies; the general public; and any interested individual or organization prior to the development of an impact statement. The process also identifies and eliminates from further detailed study issues that are not significant or that have been covered by prior environmental review.

The NEPA requires all Federal Agencies to use a systematic, interdisciplinary approach to protect the human environment. Such an approach ensures the integrated use of natural and social sciences in any planning and decisionmaking that may have an impact on the environment. The NEPA also requires the preparation of a detailed environmental impact statement (EIS) on any major Federal action that may have a significant impact on the environment. The EIS must address any adverse environmental effects that cannot be avoided or mitigated, alternatives to the proposed action, the relationship between short-term resources and long-term productivity, and irreversible and irretrievable commitments of resources. Environmental assessments (EA's) are prepared to determine if significant impacts may occur. If an EA finds that significant impacts may occur, NEPA requires preparation of an EIS. The briefest form of NEPA review is the categorical exclusion review (CER). The purpose of a CER is to verify that neither an EA nor an EIS is needed prior to making a decision on the activity being considered for approval.

c. The Alaska National Interest Lands Conservation Act (ANILCA)

In 1980, ANICLA created over 100 million acres of new national parks, refuges, monuments, conservation areas, recreation areas, forests, and wild and scenic rivers in the State of Alaska for the preservation of "nationally significant" natural resources. To address special issues and needs arising from the new land designations, ANILCA contains numerous provisions and special rules for managing Alaska's public lands and nationally important resource development potential. The ANILCA requires Federal land managers to balance the national interest in Alaska's scenic and wildlife resources with recognition of Alaska's economy and infrastructure, and its distinctive rural way of life. Title VIII of ANILCA requires that subsistence uses by "rural" Alaska residents be given a priority over all other (sport and commercial) uses of fish and game on Federal public lands in Alaska. As a compromise, Congress allowed the State to continue managing fish and game uses on Federal public lands, but only on the condition that the State of Alaska adopt a statute that made the new Title VIII "rural" subsistence priority applicable on State, as well as on Federal lands. If the State ever fell out of compliance with Title VIII, Congress required the Secretary of the Interior to reassume management of fish and game on the Federal public lands.

Section 810 of the ANILCA creates special steps a Federal Agency must take before it decides to "withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public land." Specifically, the Federal Agency must first evaluate three factors: the effect of its action on subsistence uses and needs, the availability of other lands for the purposes sought to be achieved, and alternatives which would "reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes." If the Federal Agency concludes that its action "would significantly restrict subsistence uses," it must notify the appropriate State agency, regional council, and local committee. It then must hold a hearing in the vicinity of the area involved, and must make the following findings:

- such significant restriction of subsistence uses is necessary, consistent with sound management principles for the utilization of public lands,
- the proposed activity will involve the minimal amount of public lands necessary to accomplish the purpose of such use, occupancy, or other disposition, and

- reasonable steps will be taken to minimize adverse impacts upon subsistence uses and resources resulting from such actions. (16 U.S.C. 3120(a)(3)).

In People of the Village of Gambell v. Clark, 746 F.2d 572 (9th Cir. 1984) (Gambell I), the court ruled that the "lands and waters" of the OCS were "public lands" for the purpose of this section. The court later ruled that the provisions of section 810 should not be applied in a staged manner, despite the staged decisionmaking approach set out in the OCS Lands Act and relied upon by the Supreme Court in Secretary of the Interior v. California (People of the Village of Gambell v. Hodel, Civ. No. 85-3877 (9th Cir. Oct. 25, 1985)). As a result of these rulings, the USDOI prepares an analysis under section 810 of ANILCA for OCS lease sales and plans of exploration and development/production for activities offshore Alaska. The provisions of ANILCA do not apply to the 5-Year Program because the USDOI does not make any of the above-described decisions.

d. The Clean Air Act (CAA)

The CAA, as amended, delineates jurisdiction of air quality between the U.S. Environmental Protection Agency (USEPA) and the USDOI, MMS. For OCS operations in the Gulf of Mexico, those west of 87.5° W. longitude are subject to MMS air quality regulations; operations east of 87.5° W. longitude are subject to USEPA air quality regulations.

Under the CAA, the Secretary of the Interior is required to consult with the USEPA Administrator "to assure coordination of air pollution control regulations for OCS emissions and emissions in adjacent onshore areas." The MMS established 30 CFR 250.302, 250.303, and 250.304 to comply with the CAA. The regulated pollutants include carbon monoxide, particulates, sulfur dioxide, nitrogen oxides, and volatile organic compounds (as a precursor to ozone). In areas where hydrogen sulfide may be present, operations are regulated by 30 CFR 250.417. The MMS regulations allow for the collection of information about potential sources of pollution for the purpose of determining whether the projected emissions of air pollutants from a facility could result in ambient onshore air pollutant concentrations above maximum levels provided in the regulations. These regulations also stipulate appropriate emissions controls deemed necessary to prevent accidents and air quality deterioration.

e. The Federal Water Pollution Control Act (FWPCA) and Clean Water Act (CWA)

The FWPCA establishes water pollution control activities to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. The CWA of 1977 amended the FWPCA. Title III of the CWA requires the USEPA to establish national effluent limitation standards for existing point sources of waste-water discharges which reflect the application of the best practical control technology currently available. These standards apply to existing OCS exploratory drillships, semisubmersible vessels, and jackup rigs used in exploration activities. The CWA also requires the USEPA to establish regulations for effluent limitations for categories and classes of point sources that require the application of "best available control technology economically achievable."

Section 311 of the CWA, as amended, prohibits the discharge of oil or hazardous substances into the navigable waters of the United States that may affect natural resources, except under limited circumstances, and establishes civil penalty liability and enforcement procedures to be administered by the U.S. Coast Guard. The CWA Title IV establishes requirements for Federal permits and licenses to conduct an activity (including construction or operation of facilities) that may result in any discharges into navigable waters. Section 402 of the CWA gives the USEPA the authority to issue National Pollutant Discharge Elimination System (NPDES) permits for the discharge of pollutants.

The NPDES permits apply to all sources of wastewater discharges from exploratory vessels and production platforms operating on the OCS.

f. The Coastal Zone Management Act (CZMA) and the Coastal Zone Reauthorization Amendments of 1990

Congress passed the CZMA and created the Coastal Zone Management Program to improve the management of our Nation's coastal areas. The Program, a voluntary partnership between the Federal Government and the coastal States and territories, is administered at the Federal level by the National Oceanic and Atmospheric Administration (NOAA) within the U.S. Department of Commerce (USDOC). The Program's goal is to reduce potential conflicts between environmental and economic interests in the coastal area through the use of federally-approved coastal management programs (CMP's).

The CZMA allows a coastal State or territory, with a federally-approved CMP, to review Federal activities for Federal consistency. Federal consistency is the CZMA requirement that all Federal actions that are reasonably likely to affect any land or water use or natural resource of the coastal zone be consistent with the enforceable policies of a State's/territory's CMP. Section 307 of the CZMA contains the Federal consistency provisions that impose certain requirements on Federal Agencies to comply with enforceable policies detailed in the federally-approved CMP's:

- Section 307(c)(1) requires that any direct Federal Agency activities affecting any land or water use or natural resources of the coastal zone be consistent to the maximum extent practicable with enforceable policies of the State's CMP. This section applies to OCS lease sales.
- Section 307(c)(3)(A) requires that any Federal licenses/permit affecting any land or water use or natural resources of the coastal zone be consistent with enforceable policies of the State's CMP. This section applies to geological and geophysical permits. Additionally, this section prohibits the Federal Agency from issuing the license/permit until the affected State(s) has concurred with or presumed to concur with the applicant's consistency certification or until the Secretary of Commerce has overridden the State's consistency objection to the licensed/permitted activity.
- Section 307(c)(3)(B) requires that activities affecting any land or water use or natural resources of the coastal zone, described in detail in OCS exploration or development and production plans, be consistent with enforceable policies of the State's CMP. The MMS is prohibited from approving an OCS plan until the affected State(s) has concurred with or is presumed to concur with the applicant's consistency certification, or until the Secretary of Commerce has overridden the State's consistency objection.

g. The Endangered Species Act (ESA)

The ESA of 1973 establishes policy to protect and conserve threatened and endangered species and the ecosystems upon which they depend. The ESA is administered by the USDOI, Fish and Wildlife Service (FWS) and the USDOC, National Marine Fisheries Service (NMFS). Section 7 of the ESA mandates that all Federal Agencies consult with the FWS or NMFS to ensure that any agency action is not likely to:

- jeopardize the continued existence of any endangered or threatened species, and/or
- destroy or adversely modify an endangered or threatened species' critical habitat.

The ESA requires Federal Agencies to formally consult when there is reason to believe that a listed (or proposed to be listed) species may be affected by a proposed action. Formal endangered species consultations provide a threshold examination and a biological opinion on the likelihood that the proposed activity will or will not jeopardize the continued existence of the resource, and on the effect of the proposed activity on the endangered species. The biological opinion may include recommendations for modification of the proposed activity. The FWS or NMFS notifies the Federal Agency in writing when insufficient information is available to conclude that the proposed activity is not likely to jeopardize the species or its habitat. In such cases, the Federal Agency must obtain additional information, and, if recommended by the FWS or NMFS, conduct appropriate biological surveys or studies to determine how the proposed activity may affect the endangered species or its critical habitat. After such additional information is received, FWS or NMFS would conclude the consultation process by issuing a formal biological opinion. For OCS activities in the Western and Central Gulf of Mexico Planning Areas, the MMS consults with FWS and/or NMFS at the multisale stage. This consultation covers OCS activities from lease sale through the exploration, development, production, and decommission stages. For other OCS areas, the MMS consults with FWS and/or NMFS at the lease sale stage; however, this consultation only covers leasing and exploration activities. A separate consultation is conducted for development, production and decommissioning stages.

h. The Magnuson-Stevens Fishery Conservation and Management Act (FCMA)

The FCMA of 1976 established and delineated an area from the States' seaward boundary to approximately 200 nautical miles out as a fisheries conservation zone for the United States and its possessions. The FCMA created eight regional fishery management councils (FMC's) and mandated a continuing planning program for marine fisheries management by the FMC's. Also, FCMA requires the FMC to prepare a fishery management plan (FMP), based upon the best available scientific and economic data, for each commercial species (or related group of species) of fish in need of conservation and management within each respective region.

When the Sustainable Fisheries Act of 1996 reauthorized the FCMA, Congress required the NMFS to designate and conserve essential fish habitat (EFH) for those species managed under an existing FMP. By designating EFH, Congress hoped to minimize any adverse effects on habitat caused by fishing or nonfishing activities and to identify other actions to encourage the conservation and enhancement of such habitat. The phrase "essential fish habitat" encompasses "those waters and substrate necessary to fishes for spawning, breeding, feeding, or growth to maturity." As a result of this change, Federal Agencies must consult with NMFS on those activities that may have direct (e.g., physical disruption) or indirect (e.g., loss of prey species) effects on EFH. For OCS activities in the Western and Central Gulf of Mexico Planning Areas, the MMS consults with NMFS at the multisale stage. This consultation covers OCS activities from lease sale through the exploration, development, production, and decommission stages. For other OCS areas, MMS consults with NMFS at each OCS project stage individually (e.g., the lease sale, exploration plan, development and production plan).

i. The Marine Mammal Protection Act (MMPA)

The MMPA was enacted in 1972 to ensure that marine mammals are maintained at, or in some cases restored to, healthy population levels. Jurisdiction over marine mammals under the MMPA is split between two Federal Agencies, FWS and NMFS. The FWS has jurisdiction over sea otters, polar bears, manatees, dugongs, and walrus, while the NMFS has jurisdiction over all other marine mammals.

The MMPA established a moratorium on the taking or importing of marine mammals except during certain activities that are regulated and permitted. Such activities include scientific research, public display, and the incidental take of marine mammals in the course of commercial fishing operations.

Taking is defined as “to harass, hunt, capture, or kill or attempt to harass, hunt, capture, or kill any marine mammal.” Harass is defined as any act of pursuit, torment, or annoyance that has the potential to:

- injure a marine mammal or marine mammal stock in the wild, or
- disturb a marine mammal or marine mammal stock in the wild by disrupting behavioral patterns (e.g., breathing, nursing, breeding).

Upon request, the Secretary (of either the USDOI or the USDOC, depending on jurisdiction) can authorize the unintentional taking of small numbers of marine mammals incidental to activities other than commercial fishing (e.g., offshore oil and gas exploration and development) for a period of 5 years. To authorize the taking, the Secretary must find that the total of the taking during the 5-year period (or less) would have a negligible impact on the affected species. Also, the Secretary shall withdraw or suspend permission to take marine mammals incidental to oil and gas production, and other activities, when:

- the applicable regulations concerning the methods of taking, monitoring, or reporting are not being complied with, or
- the taking is having, or may be having, more than a negligible impact on the affected species or stock.

In 1994, a new subparagraph was added to simplify the process of obtaining “small take” exemptions when unintentional taking is by incidental harassment only. Specifically, the incidental take of small numbers of marine mammals by harassment can now be authorized for periods of up to one year without the rulemaking requirement. The MMS coordinates with the FWS and NMFS to ensure that MMS and offshore operators comply with the MMPA, and to identify mitigation and monitoring requirements for permits or approvals for activities like seismic surveys and platform removals.

j. The International Convention of the Prevention of Pollution from Ships (MARPOL) and Marine Plastic Pollution Research and Control Act (MPPRCA)

In 1978, MARPOL was updated to include five annexes on ocean dumping. By signing onto MARPOL, countries agree to enforce Annexes I and II (oil and noxious liquid substances) of the treaty. Annexes III (hazardous substances), IV (sewage) and V (plastics) are optional. The United States is signatory to two of the optional MARPOL Annexes, III and V. Annex V is of particular importance to the maritime community (e.g., shippers, oil platform personnel, fishers, recreational boaters) because it prohibits the disposal of plastic at sea and regulates the disposal of other types of garbage at sea. The U.S Coast Guard (USCG) is the enforcement agency for MARPOL Annex V within the U.S. Exclusive Economic Zone (EEZ) (within 200 miles of the U.S. shoreline).

The MPPRCA is the Federal law implementing MARPOL Annex V in all U.S. waters. Under the MPPRCA, it is illegal to throw plastic trash off any vessel within the EEZ. It is also illegal to throw any other garbage (e.g., orange peels, paper plates, glass jars, and monofilament fishing line) overboard while navigating in inland waters or within 3 miles offshore. The greater the distance from shore, the fewer restrictions apply to nonplastic garbage. However, dumping plastics overboard in any waters anywhere is illegal at anytime. Fixed and floating platforms, drilling rigs, manned productions platforms, and support vessels operating under a Federal oil and gas lease are required to develop waste management plans and to post placards reflecting discharge limitations and restrictions. Garbage must be brought ashore and properly disposed of in a trash can, dumpster, or recycling container. Docks and marinas are required to provide facilities to handle normal amounts of garbage from their paying customers. Violations of MARPOL or MPPRCA may result in a fine of up to $50,000 for each incident. If criminal intent can be proven, an individual may be fined up to $250,000 and/or imprisoned up to 6 years. If an organization is responsible, it may be fined up to $500,000 and/or 6 years of imprisonment.

k. The Marine Protection, Research, and Sanctuaries Act (MPRSA)

The MPRSA of 1972 regulates the ocean dumping of waste, provides for a research program on ocean dumping, and provides for the designation and regulation of marine sanctuaries. Also known as the Ocean Dumping Act, it regulates the ocean dumping of all material beyond the territorial limit (3 miles from shore) and prevents or strictly limits dumping material that "would adversely affect human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities." Material includes, but is not limited to, dredged material; solid waste; incinerator residue; garbage; sewage; sewage sludge; munitions; chemical and biological warfare agents; radioactive materials; chemicals; biological and laboratory waste; wrecked or discarded equipment; rocks; sand; excavation debris; and industrial, municipal, agricultural, and other waste. The term does not include sewage from vessels or oil, unless the oil is transported via a vessel or aircraft for the purpose of dumping. Disposal by means of a pipe, regardless of how far at sea the discharge occurs, is regulated by the CWA through the NPDES permit process.

Title III of the MPRSA, later called the National Marine Sanctuaries Act, charged the Secretary of the Department of Commerce to identify, designate, and manage marine sites based on conservational, ecological, recreational, historical, aesthetic, scientific, or educational value within significant national ocean and Great Lake waters. The NOAA administers the National Marine Sanctuary Program. Twelve national marine sanctuaries, representing a wide variety of ocean environments, have been designated.

l. The Merchant Marine Act of 1920 (Jones Act)

The Jones Act regulates coastal shipping between U.S. ports and inland waterways. The Jones Act provides that "no merchandise shall be transported by water, or by land and water . . . between points in the United States . . . in any other vessel than a vessel built in and documented under the laws of the United States and owned by persons who are citizens of the United States . . . ." Therefore, the Jones Act requires that all goods shipped between different ports in the United States or its territories must be:

- carried on vessels built and documented (flagged) in the United States,
- crewed by U.S. citizens or legal aliens licensed by USCG, and
- owned and operated by U.S. citizens.

The rationale behind the Jones Act and earlier sabotage laws was that the United States needed a merchant marine fleet to ensure that its domestic waterborne commerce remains under Government jurisdiction for regulatory, safety, and national defense considerations. The same general principles of safety regulations are applied to other modes of transportation in the United States. While other modes of transportation can operate foreign-built equipment, these units must comply with U.S. standards. However, many foreign-built ships do not meet the standards required of U.S.-built ships and thus are excluded from domestic shipping.

The U.S. Customs Service has determined that facilities fixed or attached to the OCS used for the purpose of oil exploration are considered points within the United States. The OCS oil facilities are considered U.S. sovereign territory and fall under the requirements of the Jones Act; so all shipping to and from these facilities related to OCS oil exploration can only be conducted by vessels meeting the requirements of the Jones Act. Shuttle tankering of oil that is produced at OCS facilities can only be legally provided by U.S.-registered vessels and aircraft that are properly endorsed for coastwise trade under the laws of the United States.

m. The National Fishing Enhancement Act

The National Fishing Enhancement Act of 1984, also known as the Artificial Reef Act, established broad artificial-reef development standards and a national policy to encourage the development of artificial reefs that will enhance fishery resources and commercial and recreational fishing. The national plan identifies oil and gas structures as acceptable material of opportunity for artificial-reef development. The MMS adopted a rigs-to-reefs policy in 1985 in response to this Act and to broaden interest in the use of petroleum platforms as artificial reefs.

n. The National Historic Preservation Act (NHPA)

The NHPA of 1966 requires the head of any Federal Agency possessing licensing authority or having direct or indirect jurisdiction over a proposed Federal or federally-assisted activity to consider the proposed activity's effect on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The historic properties (i.e. archaeological resources) on the OCS include historic shipwrecks, sunken aircraft, lighthouses, and prehistoric archaeological sites that have become inundated due to the 120-meter rise in global sea level since the height of the last ice age (ca. 19,000 years ago).

Because the OCS is not federally-owned land and the Federal government has not claimed direct ownership of historic properties on the OCS, the MMS only has the authority to ensure that any agency-funded and permitted actions do not adversely affect significant historic properties. Beyond avoidance of adverse impacts, MMS does not possess the legal authority to manage the historic properties on the OCS. The MMS has conducted archaeological baseline studies of the OCS to determine where known historic properties may be located and to outline areas where presently unknown historic properties may be located. These baseline studies are used to identify "archaeologically sensitive" areas that may contain significant historic properties. Prior to approving any OCS exploration or development activities within an archaeologically sensitive area, MMS requires the lessee to conduct a marine remote sensing survey and to prepare an archaeological report. If the marine remote sensing survey indicates any evidence of a potential historic property, the lessee either must:

- move the site of the proposed lease operations a sufficient distance to avoid the potential historic property, or
- conduct further investigations to determine the nature and significance of the potential historic property.

If further investigation determines that there is a significant historic property within the area of proposed OCS operations, NHPA consultation procedures are followed.

o. The Oil Pollution Act (OPA 90)

The OPA 90 establishes a single uniform Federal system of liability and compensation for damages caused by oil spills in U.S. navigable waters. The OPA 90 requires removal of spilled oil and establishes a national system of planning for and responding to oil-spill incidents. Additionally, OPA 90 includes provisions to:

- improve oil-spill prevention, preparedness, and response capability;
- establish limitations on liability for damages resulting from oil pollution;
- promote funding for natural resource damage assessment;
- implement a fund for the payment of compensation for such damages; and
- establish an oil pollution research and development program.

The USCG is responsible for enforcing vessel compliance with OPA 90. The Secretary of the Interior is given authority over offshore facilities and associated pipelines (except deepwater ports) for all Federal and State waters, including responsibility for spill prevention, oil-spill contingency plans, oil-spill containment and cleanup equipment, financial responsibility certification, and civil penalties. The Secretary of the Interior delegated this authority to MMS.

The MMS regulations governing oil-spill financial responsibility (OSFR) for offshore facilities and related requirements for certain crude oil wells, production platforms, and pipelines located in the OCS and certain State waters became effective in October 1998. The regulations implement the OPA requirement for responsible parties to demonstrate they can pay for cleanup and damages caused by facility oil spills. Responsible parties can be required to demonstrate as much as $150 million in OSFR if MMS determines that it is justified by the risks from potential oil spills from the covered offshore facilities. The minimum amount of OSFR that must be demonstrated is $35 million for covered offshore facilities located in the OCS, and $10 million for covered offshore facilities located in State waters. The regulation exempts persons responsible for facilities having a potential worst-case, oil-spill discharge of 1,000 bbls or less, unless the risks posed by a facility justify a lower threshold.

p. The Outer Continental Shelf Deep Water Royalty Relief Act

The Outer Continental Shelf Deep Water Royalty Relief Act of 1995 authorizes thc Secretary of the Interior to offer OCS blocks for lease with suspension of royalties for a volume, value, or period of production. Deepwater royalty relief applies to blocks offered for lease in the western and central Gulf of Mexico in water depths exceeding 200 m through November 28, 2000. The MMS has developed procedures for suspension of royalty payment on production from eligible leases.

q. The Ports and Waterways Safety Act

The Ports and Waterways Safety Act authorizes the USCG to designate safety fairways, fairway anchorages, and traffic separation schemes to provide unobstructed approaches through oil fields for vessels using ports. The USCG regulations provide listings of these designated areas along with special conditions related to oil and gas production. In general, no fixed structures such as platforms are allowed in fairways. Temporary underwater obstacles such as anchors and attendant cables or chains attached to floating or semisubmersible drilling rigs may be placed in a fairway under certain conditions. Fixed structures may be placed in anchorages, but the number of structures is limited.

r. The Resource Conservation and Recovery Act (RCRA)

The RCRA provides a framework for the safe disposal and management of hazardous and solid wastes. Most oil-field wastes have been exempted from coverage under RCRA’s hazardous waste regulations. Any hazardous wastes generated on the OCS that are not exempt must be transported to shore for disposal at a hazardous waste facility.

2. Executive Orders (EO)

a. Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (February 1994)

The Executive Order on environmental justice (EJ) provides that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." In August 1994, the Secretary of the Interior directed its bureaus to include EJ in NEPA documentation, and in February 1998, the CEQ issued guidance to assist Federal Agencies in addressing EJ.

The EO requires Federal Agencies to incorporate into its NEPA documents analysis of the environmental effects of its proposed programs on minorities and low-income populations and communities. The EJ issues encompass a broad range of impacts covered by NEPA, including impacts on the natural or physical environment and interrelated social, cultural, and economic effects. Thus, these effects must be considered I EIS's and EA's. The EJ concerns may arise from impacts on the natural and physical environment (such as human health or ecological impacts on minority populations, low-income populations, and Indian tribes) or from related social or economic impacts.

The issue of disproportionate, OCS-related impacts has primarily focused on Alaska where subsistence hunting, fishing, and gathering activities occur in coastal areas. However, EJ concerns are considered anywhere (including the Pacific and Gulf of Mexico Regions) where OCS projects and associated NEPA documentation occur.

b. Executive Order 13007: Indian Sacred Sites (May 1996)

The Indian Sacred Sites EO directs Federal land managing Agencies to accommodate access to, and ceremonial use of, Indian sacred sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites. It is MMS's policy to consider the potential effects of all aspects of plans, projects, programs, and activities on Indian sacred sites, and to consult, to the greatest extent practicable and to the extent permitted by law, with tribal governments before taking actions that may affect Indian sacred sites located on Federal lands.

c. Executive Order 13089: Coral Reef Protection (June 1998)

This EO directs the U.S. Coral Reef Task Force, co-chaired by the Secretaries of Interior and Commerce, to develop and implement a comprehensive program of research and mapping to inventory, monitor, and "identify the major causes and consequences of degradation of coral reef ecosystems." Additionally, the EO directs Federal Agencies to protect coral reef ecosystems and, to the extent permitted by law, prohibits them from authorizing funding or carrying out any actions that will degrade these ecosystems. Relatedly, the USDOI works with domestic and international partners through the Coral Reef Initiative. This initiative focuses efforts to protect and monitor coral reefs around the world by building and sustaining partnerships, programs, and institutional capacities at the local, national, regional, and international levels.

d. Executive Order 12114: Environmental Effects Abroad (January 1979)

This EO requires that Federal officials be informed of environmental considerations, and take those considerations into account when making decisions on major Federal actions that could have environmental impacts anywhere beyond the borders of the United States, including Antarctica. Such Federal actions include:

- all major Federal actions significantly affecting the environment outside the jurisdiction of any nation (the oceans or Antarctica). This would apply to proposals that result in actions within the United States, which because of ocean currents, winds, stream flow, or other natural processes, may affect parts of the oceans not claimed by any nation (high seas). Included in this category would be an OCS project that, because of ocean currents, could result in effluents or spilled oil reaching fishing grounds or areas not claimed by another nation.
- all major Federal actions significantly affecting the environment of a foreign nation not involved in the action. This would apply to proposals that result in actions within U.S. territory, or within the EEZ that, because of ocean currents, winds, stream flow, or other natural processes, may affect parts of another nation, or seas or oceans within the jurisdiction of other nations. This category would include an OCS project located upcurrent from the Mexican coastline that could affect Mexico's territory in the event of an oil spill. Also in this category are all major Federal actions in which a foreign nation is a participant and that would normally be covered by the EIS addressing the U.S. part of the proposal. An example would be an OCS right-of-way pipeline bringing Canadian energy resources to the northeast United States.
- all major Federal actions providing a foreign nation with a product, or involving a project that produces an emission or effluent prohibited or regulated by U.S. Federal law because of its effects on the environment or the creation of a serious public health risk.

Federal actions causing significant impacts on environments outside the United States are to be addressed in:

- EIS's (generic, program (5-Year OCS Program EIS), and project-specific (OCS lease sale EIS);
- documents prepared for decisionmakers containing reviews of environmental issues involved in Federal actions, or summaries of environmental analyses (e.g., OCS lease sale decision documents, Records of Decision); and
- environmental studies or research prepared by the United States and one or more foreign nations, or by an international body in which the United States is a member or participant.

The United States, Canada, and Mexico are negotiating a Transboundary Environmental Impact Assessments (TEIA) Agreement through the North Atlantic Free Trade Agreement (NAFTA) Commission on Environmental Cooperation (CEC). The CEC deals with a wide range of environmental and natural resource protection issues common to Canada, the United States, and Mexico. Developing a TEIA process is one of the requirements of the 199l North American Agreement on Environmental Cooperation. Under this agreement, a transboundary environmental impact is any impact on the environment within the area under the jurisdiction of Canada, the United States, or Mexico caused by a proposed project, the physical origin of which is situated wholly or in part within the area under the jurisdiction of one of the three countries. For example, a proposed project on the United States OCS that, because of ocean currents, winds, or proximity to the Mexican coastline, could affect Mexican waters (fishing industry, fish resources, etc.) or the Mexican coastline (oil spill contacts, etc.) would be a project considered to have the potential to cause transboundary environmental impacts. The agreement recognizes that there is a significant bilateral nature to many transboundary issues and calls upon the three countries to develop an agreement to:

- assess the environmental impacts of proposed projects in any of the three countries party to the agreement (NAFTA) which would be likely to cause significant adverse transboundary impacts within the jurisdiction of any of the other parties;
- develop a system of notification, consultation, and sharing of relevant information between countries with respect to such projects; and
- give consideration to mitigating measures to address the potential adverse effects of such projects.

Negotiations are currently underway between the three parties to the agreement, but the final language had yet to be worked out. Because the requirements of the assessment portion of the agreement are somewhat similar to the requirements imposed by EO 12114, i.e. impacts to foreign territory must be addressed in NEPA documents, MMS requires that EIS's prepared on major Federal OCS actions contain an assessment of potential significant impacts to foreign territory.

e. Executive Order 13158: Marine Protected Areas (MPA's) (May 2000)

The EO defines an MPA as "any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." The EO directs Federal Agencies to work closely with State, local, and nongovernmental partners to create a comprehensive system of MPA's "representing diverse U.S. marine ecosystems, and the Nation's natural and cultural resources." Ultimately, the MPA system will include new sites, as well as enhancements to the conservation of existing sites. Five principal components of the EO are:

- National MPA List: The USDOC and the USDOI will develop and maintain a national list of MPA's in U.S. waters. Candidate sites for the list are drawn from existing programs for Federal, tribal, State and local protected areas. When completed, the list and the companion data on each site will serve several purposes such as ensuring that agencies "avoid harm" to MPA's, providing a foundation for the analysis of gaps in the existing system of protections, and helping improve the effectiveness of existing MPA's.
- The MPA Web Site: The USDOC and USDOI will develop and maintain a publicly accessible Web site to provide information on MPA's and Federal Agency reports required by the EO. Also, the web site will be used to publish and maintain the National MPA List and other useful information, such as maps of MPA's; a virtual library of MPA reference materials, including links to other web sites; information on the MPA Advisory Committee; activities of the national MPA Center; MPA program summaries; and background materials such as MPA definitions, benefits, management challenges, and management tools.
- The MPA Federal Advisory Committee: Created to provide expert advice on, and recommendations for, a national system of MPA's, this advisory committee will include nonfederal representatives from science, resource management, environmental organizations, and industry.
- The Mandate to Avoid Harmful Federal Actions: This mandate directs Federal Agencies to avoid harm to MPA's or their resources through activities that they undertake, fund, or approve.
- The MPA Center: The EO directs NOAA to create a Marine Protected Areas Center (MPA Center). In cooperation with the USDOI and working closely with other organizations, the MPA Center will coordinate the effort to implement the EO and will:

– develop the framework for a national system of MPA's;
– coordinate the development of information, tools, and strategies;
– provide guidance that will encourage efforts to enhance and expand the protection of existing MPA's and to establish or recommend new ones;

- coordinate the MPA web site;
- partner with Federal and nonfederal organizations to conduct research, analysis, and exploration;
- help maintain the National MPA List; and
- support the MPA Advisory Committee.

f. Executive Order 13112: Invasive Species (February 1999)

The EO defines an "invasive species" as a species that is nonnative (or alien) to the ecosystem under consideration and whose introduction causes or is likely to cause, economic or environmental harm or harm to human health. This EO requires all Federal Agencies to:

- identify any actions affecting the status of invasive species;
- prevent invasive species introduction;
- detect and respond to and control populations of invasive species in a cost-effective and environmentally sound manner;
- monitor invasive species populations accurately and reliably;
- provide for restoration of native species and habitat conditions in invaded ecosystems;
- conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species;
- promote public education on invasive species and the means to address them; and,
- refrain from authorizing, funding, or carrying out actions that are likely to cause or promote invasive species introduction or spread, unless the Agency has determined that the benefits of such actions clearly outweigh the potential harm caused by invasive species and that all feasible and prudent measures to minimize risk of harm will be taken.

Additionally, the EO established the National Invasive Species Council (Council), co-chaired by the Secretaries of Agriculture, Commerce and the Interior, and comprised of the Secretaries of State, Treasury, Defense, and Transportation, and the Administrator of the Environmental Protection Agency. The Council:

- provides national leadership on invasive species;
- sees that Federal efforts are coordinated and effective;
- promotes action at local, State, tribal and ecosystem levels;
- identifies recommendations for international cooperation;
- facilitates a coordinated network to document and monitor invasive species;
- develops a web-based information network;
- provides guidance on invasive species for Federal Agencies to use in implementing the NEPA; and
- prepares an Invasive Species Management Plan to serve as the blueprint for Federal action to prevent introduction; provide control; and minimize economic, environmental, and human health impacts of invasive species.

The MMS requires that EIS's prepared on major Federal OCS actions (e.g., 5-Year OCS Program and OCS lease sales) contain an assessment of the proposed action's contribution to the invasive species problem.

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Minerals Revenue Management** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.